MULTIPLE EARTHED NEUTRALS

The ELECTRICAL REVIEW

FOUNDED 1872

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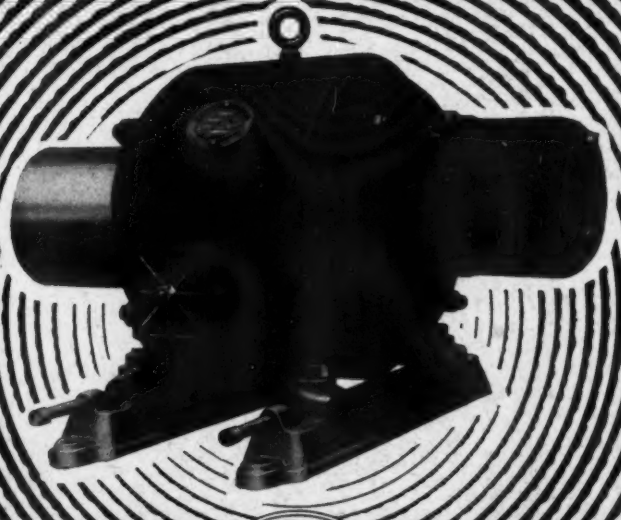

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1933

The
Electrical Review

VOL. CXII. APRIL 7, 1933. No. 2889

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW, 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 5871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Practical Criticism

IN a paper read before the London Technical Group of the Electrical Power Engineers' Association, Mr. H. C. Gamble, with commendable frankness, criticises some of the shortcomings of electrical apparatus. We believe that informed criticism of this kind from men who come into contact with the installation and consumers' end of the work is just what is required.

Modern domestic electrical apparatus of various kinds is sound in general design and construction, but all who use it know that there is much room for improvement in detail. The majority of the imperfections can be rectified at little expense by the exercise of practical ingenuity or organising ability.

One of the most important needs, if we are to retain the consumers' confidence, is prompt delivery of spare parts; shortcomings here are no doubt largely due to the rapid improvements made by manufacturers during the past few years, which have made it difficult to keep adequate stocks to meet all cases. This defect will gradually become less obvious, especially in view of the tendency to reduce the number of models of cookers marketed by individual firms—a necessary move towards standardisation.

The difficulty in obtaining spares, however, is also in part due to the sale of cheap foreign apparatus by some stores, which sell the original article, but are not interested in its subsequent history.

The question of where the fuses of a cooker should be mounted calls for a regard for the conditions of use, as often the limited space available for installation prevents what would otherwise be a satisfactory design being the best in practice, but the layout of connections referred to by the author of the paper is surely an isolated case, as we were particularly struck by the improvements in this direction exemplified at the British Industries Fair. We think his suggestion regarding the provision of a spare fuse carrier, ready wired, is excellent; this should be applied also to the lighting installation.

The bowl fire certainly should not be used in bathrooms, which can be heated by panel units fixed on the walls, but we should not condemn its use everywhere on that account; the same reasoning surely applies to the use of any portable appliance. Neither do we agree that safety devices for kettles—human forgetfulness being what it is—are not worth the quite small additional charge made for them. Also why should the additional expense of unkinkable flex trouble us? Its merits are obvious and the length required in most cases is very small.

Mr. Gamble thinks that the sale of cheap apparatus by stores could be prevented by giving supply undertakings a monopoly of the sale of domestic appliances. Another way would be to adopt the Canadian method making it illegal to sell apparatus that has not been approved by the official testing authority.

Electrical Benevolence

THE electrical man has to grope his way through a veritable forest of initial letters. Only last week his confusion found expression in a letter received from a South African reader: "I wish you would publish a dictionary of the abbreviated titles of the numerous societies that have sprung up, E.A.W., E.P.E.A., and so on." To others besides this reader, what is intended to be a time-saving device is in actual experience more or less of a nuisance. We wonder whether there is another industry which has so many sectional abbreviations to remember. A further trial of patience follows a change of name. For instance the Electrical Trades Benevolent Institution which has been operating under the familiar letters "E.T.B.I." for twenty-eight years until they have really become a household word has, through the wisdom of its administrators, been changed to "Electrical Industries Benevolent Association" and in future, when we get used to it, we shall all know this very deserving organisation as the "E.I.B.A." The rules and bylaws have been modernised and we have pleasure in seconding the appeal issued by Mr. R. P. Sloan, the presi-

dent, simultaneously with particulars of the changes for new members and new contributions. The organisation has rendered aid in many thousands of distressing cases in the past and has much serious work awaiting it. Captain Keeping, the secretary (9, Southampton Street. W.C.1), or any of the local honorary secretaries will gladly provide information and receive cheques—or stamps.

Service to the Consumer

How to give the best service to the domestic consumer is one of the most important points to be considered as we come more and more closely to grips with the commercial development of electricity supply. Mr. P. J. Morley, in the course of the discussion reported on page 488, eulogised the fine repair organisation of the Wimbledon municipal electricity undertaking. He, like Mr. Gamble, predicts that the time will come when the sale and installation of domestic appliances will be done solely by electricity supply authorities—retail shops and back-street trading being entirely abolished. That he is not by any means alone in holding this opinion our readers are well aware. Naturally enough, there are sections of the industry thinking very differently, but ultimately the voice of the consumer will prevail, and we shall do our best both for the electricity supply and for the general electrical industry if we keep that practical certainty in mind. It may happen that lighting fittings and such like will remain with the contractor and retailer. but the maintenance of appliances calls for the consistent care of the domestic electrical engineer, who will always be available when required. Among the contractors only the more reputable seem to be equipped for giving efficient service.

Unfair Discrimination

In some areas, where gas and electricity are under the same control, the undesirability of duplicating capital expenditure on mains has been used as an argument against vigorous electrical development—a plea that would be more reasonable if the two methods were of equal merit. Nevertheless, the Gas Light & Coke Co. seeks to perpetuate this duplication for its own benefit in a Bill which purports to prevent local authorities from specifying the form of energy to be used on housing schemes. It is seemingly impartial as between electricity and gas, but obviously local councils would not adopt the latter exclusively in new buildings, and they must make a definite choice at the outset; bias is absent for, as Sir David Milne Watson stated, many of them do not own electricity undertakings. He said that the L.C.C. encourages the use of gas for heating and cooking and electricity for lighting. If it were not that the L.C.C. has to make the best of existing conditions, one might term this unfair discrimination in favour of gas, as the consumption for cooking and heating in the old all-gas houses is about two-thirds of the total.

The Devil's Due

An American electrical contemporary asks whether the victim of gas is " any deader on the battlefield than on the kitchen floor." We refer the question to the publicity organisation in this country which so attractively sets forth the merits of a " Therm." Our contemporary rebukes the gas interests for their silence regarding the number of people killed from the hazard of the domestic gas range, and turns to the 1932 statistics of the Department of Health of the City of New York for the information. Here it is: The number of deaths caused by illuminating gas poisoning (exclusive of suicides) was 279—nearly one-fourth of the total number of deaths from automobile accidents! Hitherto it has been considered a mark of good manners in an electrical man across the Atlantic not to mention the dangers in the use of gas, but this is now regarded as a conspiracy of silence, leaving the public unwarned. After all, it is asked, in effect, why should we spare the feelings of the gas man when we attack his pocket? Characterising such an attitude as cowardly complacency, the writer adds: " The gas range should be publicly branded as dangerous," and he hopes to see " some electrical man have guts enough to agitate for a safety first campaign in the home." Hello! Hello! Temple Bar 4569. Are you there?

At Last?

By means of questions in Parliament, members are keeping the matter of railway electrification to the fore. One such last week brought a reply from the Minister of Transport by which it was conveyed that when the London Passenger Transport Bill becomes law the London and North Eastern Railway will submit definite electrification proposals to the Standing Joint Committee of the new Transport Board which the Bill sets up. The scheme upon which the question was raised is that affecting lines from Liverpool Street Station out to Ilford and beyond. Such projects have been in the air for decades—to witness the completion of such a piece of work would indeed be something to live for!

The Choice

In his presidential address to the I.E.E. London Students' Section, Professor E. W. Marchant pointed out that success is most likely to be achieved in work in which the practitioner is most interested. But by success is not necessarily meant financial recognition, which is related to the type of work which the public thinks it wants most. Those with a special aptitude for scientific research must look to the interest of the work and to the possibility of prestige as their chief rewards, but the number of men required in this field is limited. At the other end are those whose task is to apply the finished product of the invention to the needs of industry, which is often work calling for high technical qualifications and for a breadth of view to envisage non-electrical manufacturing conditions. Here the field is being rapidly enlarged for those able to seize the opportunity, and the material recognition should be relatively good. In between these, as our correspondence columns have borne witness only too well lately, the scope is small, even for good engineers. Those with experience who advise entrants to the profession how best to direct their energies, according to their individual aptitudes, are performing a good work of which the importance to our industry cannot be overestimated.

Efficiency of Generation

While we have on innumerable occasions urged that it is more important to improve the efficiency of distribution than of generation, we cannot subscribe to the view, apparently held by some responsible engineers, that we need not therefore strive after securing small economies in the use of fuel. There is no reason why we should not do both; the same men would not be employed for both purposes. The practical bearing of thermal efficiency is that (unlike the major factors in distribution) it influences the cost of every kWh produced. Even a small reduction in generating cost can make the difference between securing and losing certain classes of industrial load, and it is such loads that have altered the whole scale and reduced the costs of electricity supply generally. We welcome the news that in 1932 the Kearsley station of the Lancashire Electric Power Co. lowered its coal consumption to 1.197 lb. per kWh generated from 1.2 lb., with which it secured first place in the country in 1931, when it was second only to Deptford in thermal efficiency.

Economy in Flint

The ratepayers of the village of Mostyn (Flintshire) last week rejected by a large majority a scheme for the electric lighting of the streets proposed by the Mostyn and Darwen Iron Co. A Mr. Hughes contended that as Providence had provided them with a moon and stars to light the village it was better to continue with that form of illumination!

The Prudential Assurance Company's Extension. **(See page 486)**

1. The conference hall. 2. The directors' common room. 3. One of the staircases. 4. The main entrance hall. 5. The vestibule in the directors' suite with silvered ceiling and concealed lights. 6. The generating plant. 7. The directors' dressing room. 8. A specially designed fireplace

D

Testing Current Transformers. By G. W. Stubbings, B.Sc., A.M.I.E.E.

A new "null" method

NEARLY all methods of testing current transformers for accuracy of ratio and phase are subject to one of two serious limitations. With the so-called absolute methods, in which the potential drops on standard resistances in the primary and secondary circuits are compared, the secondary burden must include the standard resistance used for the test and is not under control; a similar objection applies to the Shotter method, employing a double wattmeter, as the current coil of the wattmeter is included in the secondary burden.

In the so-called comparison methods, the difference between the secondary currents of two transformers of identical ratio and carrying the same current is measured. This method is accurate only if the circuit in which the difference current is measured has a negligible impedance; as the magnitude of the difference currents is usually of the order of a few milliampères, this condition is very difficult to satisfy.

The first of the limitations referred to above is not of any moment in acceptance tests of current transformers, as the British Standard limits of error are specified in reference to a non-inductive burden whose impedance exceeds that of the standard resistance used. When, however, it is desired to measure the errors of a current transformer with a stipulated burden of low impedance and partially inductive, such as the current coils of watt-hour meters, it is not easy to infer, from the errors of a transformer with a non-inductive burden, what its performance will be with a small partly inductive burden.

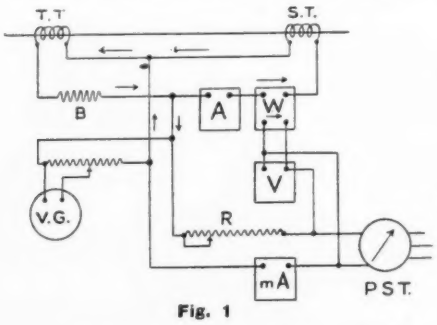


Fig. 1

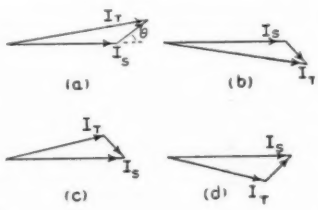


Fig. 2

The method of current transformer testing now described is one of comparison, but the arrangement for measuring the difference between the secondary currents of the standard transformer and the one under test gives the equivalent of an instrument of zero impedance.

Testing Connections

The diagram of the connections for the test is shown in fig. 1. The standard and the test transformers are indicated respectively by S.T. and T.T. These transformers are of identical nominal ratio. The primary windings are connected in series, and the secondary windings are connected for circulation. B represents the burden of the test transformer, with which the errors are to be determined, and A and W are respectively a standard ammeter and wattmeter, with which the errors of the standard transformer are known.

To points of the circulating current system intermediate between the burdens of the two transformers is connected a circuit supplied from the secondary of a phase-shifting transformer and including an adjustable resistance R and milliammeter mA; a vibration galvanometer is connected to the same points. In determining the difference between the errors of the two transformers for any value of the primary current the phase shifter is set so that W reads zero, thus identifying the position of the rotor corresponding to a quadrature phase relation of the transformer secondary current and the phase shifter secondary voltage; the magnitude and phase of the current supplied from the phase shifter is then adjusted so that a null indication is given by the vibration galvanometer.

The magnitude of this current, as indicated on mA, and its phase, as given by the phase shifter, are then identical with the difference between the secondary currents of the two transformers when carrying the burdens comprised in the circulating currents circuit. When the vibration galvanometer is giving a null indication, there is no difference of potential between the two points at which the milliammeter circuit is connected to the circulating current circuit. The milliammeter circuit, comprising the instrument, resistance, and phase shifter, thus behaves as an instrument having zero impedance.

Upon the interpretations of the indications of the phase shifter and wattmeter depends a correct inference as to whether the errors of the test transformer are smaller or greater than those of the standard. Four possible relations of the two sets of errors are shown by the vector diagrams in fig. 2. To identify to which of the conditions the circumstances of the test correspond we must know the direction of the milliammeter current with respect to that in the circulating current system, and whether this milliammeter current leads or lags in phase on the main secondary current. The relative directions of the circulating current and that in the milliammeter are indicated by the polarity of the wattmeter reading, while the sense of the phase difference is indicated directly by the phase shifting transformer. In fig. 1 the wattmeter is giving a positive reading, and the secondary current of T.T. is evidently greater than that of S.T.

An Alternative Arrangement

It is not difficult to arrange the connections to suit the conditions when a phase shifter is not available. Thus in fig. 3 the arrangement comprises a pair of potentiometer rheostats connected between two pairs of phases of a three-phase system. The magnitude and phase of the milliammeter current is adjusted to give a null indication of the vibration galvanometer, and the readings of the wattmeter, ammeter and voltmeter, are observed when this adjustment has been made, as well as that of the milliammeter.

Since the milliammeter current is in phase with the phase shifter voltage which excites the wattmeter, the phase difference between this current (i) and the wattmeter current will be equal to arc cos W/IV. The component of the milliammeter current in phase with the secondary current I_1 will thus be i.W/IV, and calling this current I_1, the component in quadrature with the main secondary current, I_2, will be $\sqrt{(I^2-I_1^2)}$. The differences between the ratio and phase errors of the two transformers will be respectively I_1/I and I_2/I. The sign of the difference between the ratio errors is determined by the same considerations as those applicable to the test with the phase shifting transformer. The sense of the phase difference is determined by adjusting the position of the sliding contacts of the two rheostats so that the voltage lags slightly on its original phase value, its magnitude, as indicated by the voltmeter, being kept constant. If, when this modification of phase is made, the wattmeter reading increases, this will indicate that the milliammeter current is leading on the secondary current of the transformer as is indicated in fig. 2 (A) and (D). If the wattmeter reading diminishes with the lag of the milliammeter current, this will indicate that the conditions correspond to one of the vector diagrams, fig. 2 (B) and (C).

The theoretical accuracy of the method might be questioned on the ground that as the wave form of the phase shifter current is approximately sinusoidal, and that of the difference current is considerably distorted, the former current can never exactly balance the latter. The null indication of the vibration galvanometer will refer to the fundamental of the alternating voltage difference across the instrument, and when this indication is obtained there will still be a potential difference due to the harmonics in the different current. This objection applies to any absolute method in which the voltage drops across two resistances are compared, since, as the wave forms of the primary and secondary currents can never be exactly alike, there will always be a residual potential difference which the vibration galvanometer, being a resonant instrument, is unable to detect.

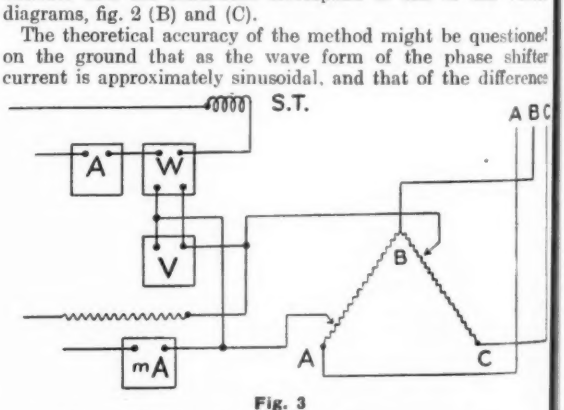


Fig. 3

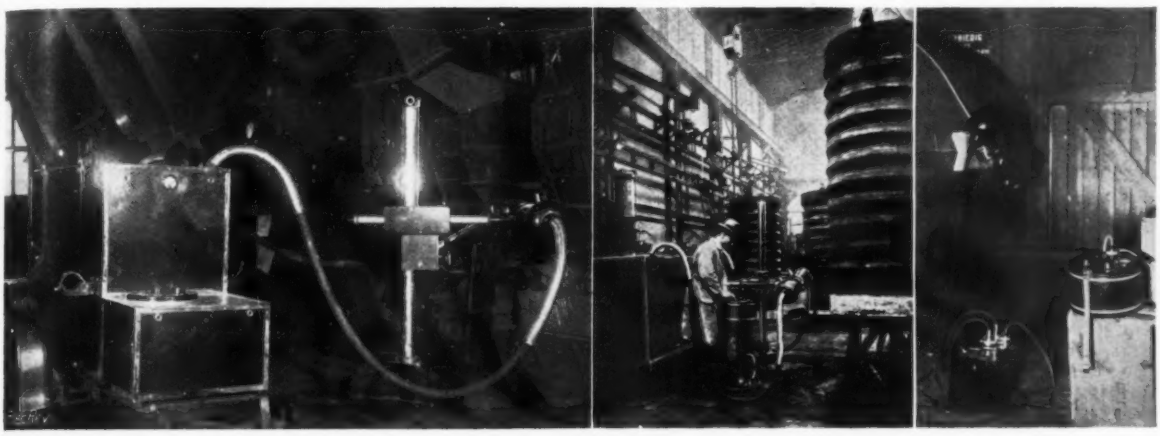
A similar objection applies to comparison methods of current transformer testing, in which a wattmeter is used to measure the difference current. This wattmeter will be excited by a

voltage of approximately sinusoidal wave form, and it will therefore only measure the fundamental of the difference current and will reject the harmonics. The failure of indirect methods of current-transformer testing to detect the harmonics of the difference current is of no importance when phase errors are concerned, since the phase difference between the primary and the secondary currents may be presumed to be measured with reference to a datum voltage of sinusoidal wave form. The ratio error, however, might be taken to refer to the fractional difference between the virtual values of the primary and secondary currents, and this fractional error, it would seem, cannot be measured with rigorous accuracy by any indirect method, owing to the difference of the wave forms of the two currents.

X-rays and the Welder. By R. H. Stephens

DURING the last decade, the growth of welding has been continuous and rapid. When the best materials are utilised under ideal conditions, a very close approach to the strength of the material to be welded is effected, but, even with the highest quality materials, exceedingly bad welds may be made, the defects of which may be hidden.

Numerous proprietary electrodes are available; some bare wire, some with thick, some with thin coatings, some fast and some slow running. The procedure recommended by the makers differs appreciably; conditions too may vary in each works (*e.g.*, the type of machine used), and this introduces further factors which give rise to further variations. Gradually electrodes for high current strengths are being introduced, the use of which will speed up welding and reduce costs. Furthermore, in each of the numerous ways of effecting fusion, a number of variables are automatically introduced, which must always be taken into account. The optimum working conditions are therefore not always easily obtained.



Left: Mobile apparatus in a power house; centre: a stationary equipment being used for the examination of fire boxes; right: inspecting a pressure vessel with apparatus suitable for steel up to ¾ in. thick

A Scarcity of Good Operators

It is on the side of personnel, however, that the main complexities arise. With any increase in ship-building or with any improvement in the heavy industries, difficulties in obtaining good welders will be pronounced. The need for skilled supervision, too, will become more and more evident. In the more important applications of welding, in which it is essential that the best quality work should be carried out, the subject of testing commands attention. Nowadays, the properties of weld metal are well known, and little difficulty exists in specifying quality. The quality of the workmanship, however, remains a problem. What constitutes a good welder?

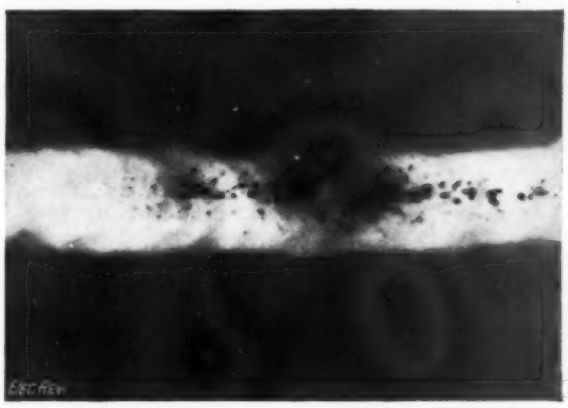
A destructive test yields certain data on the quality of weld metal and the momentary standard of workmanship of the welder responsible. In some cases, for low stressed structures, stringent testing may be superfluous. For a tremendous range of constructions, too, it would be folly to propose a complete survey of every welded joint; should such a demand be enforced it would rule out the use of welding in many cases. It would be equally fallacious to consider that because, in most instances, a complete survey will prove uneconomical, the X-ray method is of no practical utility.

One way of surmounting this difficulty is to examine by X-rays a certain number of welds selected at random. Consistently good welders have nothing to fear from an X-ray test. There is no doubt that such a course would exert a salutary effect, and it would not be difficult to select a standard, and in this way consistency in any welder (which is the required qualification) might be assessed. As a result of the introduction of X-ray methods of investigation in aircraft factories during the war, the quality and consistency of the work was considerably improved.

In works where X-rays have been used for the examination of welds, their value is recognised as a means of verifying the good work which can be and has been carried out. Despite all the numerous variables, excellent welds are far more common than is generally supposed. There will be much greater confidence in, and a more universal application of, welding when continued testing has shown a consistently high standard of quality and workmanship.

It may be asked whether X-ray examination is so costly that only the larger firms can afford to employ it. This depends upon the nature of the apparatus, the size, performance and cost of which depends on the class of work desired to be examined. A large proportion of welded steel plate is less than ¾ in. in thickness. X-ray apparatus to examine plate of this nature is small and compact and reasonable in cost.

In works running fairly large welding sections X-ray examination is of the greatest utility, not only for purposes of test but for development work, for which constant research is essential. As modern tendencies are toward faster and faster rates of deposit with an accompanying reduction in labour costs per foot of weld, the need for efficient testing is imperative. High rates of deposit involve greater technical difficulties, for joints have to be effected in a shorter time. For investigation of these factors, the X-ray method supplementary to other methods is indispensable, and there is at least one firm in existence in Great Britain prepared to carry out examinations. Schemes of this nature are of great importance for it may be some time before standards are devised and courses planned to which the welding industry may conform.



Radiograph of an oxy-acetylene weld showing gas bubbles and porosity due to an excess of acetylene

There are many signs which indicate that the worth of the X-ray method of testing welds is recognised by engineers in practically every country. Welded boilers, welded buildings, welded bridges, welded pen-stocks are now no novelties. There are welded mercury boiler drums 4½ in. thick. At the Hoover Dam literally miles of welded joints will be made—all of which, I understand, will be X-rayed.

Multiple Earthed Neutrals. By T. C. Gilbert, A.M.I.E.E.

IN the ELECTRICAL REVIEW of October 28th last, there appeared an article entitled "Multiple Earthing," by W. T. Taylor, which concluded with the words "the multiple earthing system is usually condemned by those with no practical experience of it, and their arguments against its use are high earth currents, or a poor earth at the consumer's premises, but never at the supply end or any point of the single earth return. Why condemn a system for these or any other readily correctable faults?"

Multiple earthing is not practised in this country in connection with public supply systems, being expressly forbidden under the Electricity Commissioners' Regulations, El. C. 12a, Clause 3 ("Insulation Test") and El. C. 12a, Clause 44 ("Connection of Circuits with Earth; A.C. Circuits"). The first of these says that the insulation of every circuit shall be so maintained that the leakage current shall not exceed one-thousandth part of the maximum current, and the second that if an a.c. circuit is connected to earth, connection shall only be made at the place where energy is delivered to the circuit, and that this connection shall be made to the neutral point of the star winding. Experience of the system abroad does not seem to bear out the contentions regarding its complete efficiency in securing greater safety for the consumer.

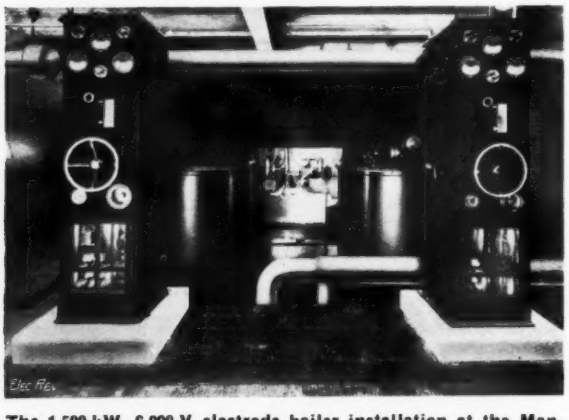
I write not in criticism of this system, but in order to ensure, if possible, that if and when multiple earthing is adopted in this country—and as it is being advocated in very influential quarters its adoption would appear to be a matter of time only—then such earthing must definitely stop *outside* the consumer's installation, and in no circumstances be extended into the interior arrangements.

Undoubtedly, with multiple earthed neutrals, the question of the adequate protection of consumers' apparatus (and the consumer) against leakage or neutral potentials becomes more acute than without multiple earthing, if only because currents of greater or less magnitude will practically always be flowing over the earthing electrode or electrodes. The resistance of such electrodes rises enormously with the passage of comparatively heavy currents over them; that such currents *will* flow is one of the author's arguments in favour of multiple earthing, in that "it enables a much smaller gross total section of distribution neutral-return copper" to be used. Such currents must flow if all the other advantages claimed—increased protection, improved service, and fewer burn-outs—are to be obtained. I believe that such advantages *can* be secured by a system of multiple earthing of the neutral, but also that unless special precautions are taken regarding the earthing of consumers' apparatus then the first advantage claimed, the safety of the consumer, cannot be secured.

A New Zealand Instance

Another opinion in support of this statement is that of the general manager of the Christchurch (N.Z.) Municipal Electricity Department, "If an earthed-neutral system is to be effectively earthed, the idea of multiple earthing is sound, but in actual practice the multiple earths are often quite perfunctory, and if the safety of users depended on these multiple earths, their safety would *not* be assured. The aim of this Department has been to so ensure the effectiveness of its main earths at sub-stations, coupled with the provision of an ample capacity in the neutral mains, that the neutral throughout the system is usually the best earth obtainable. As the conduit is connected to the neutral and to an independent earth also, the position is that the neutral is assured and each one of the multiple earths that is provided is an added help."

The methods adopted by this authority are, I consider, about the worst possible in that the varying neutral potentials are extended into the consumer's installation by means of the earth-cum-neutral connection. This has, in fact, proved a great difficulty in America, and also in Canada, where responsible authorities are seriously perturbed by the menace of the poorly earthed neutral. For instance, the Western Canada Insurance Underwriters' Association, of Winnipeg, Manitoba, states "that the movement to bond together conduit and other metal frames to the supposedly grounded service contactor is growing, and it is rather disquieting to see that certain central station interests seem to be behind this move."



The 1,500-kW, 6,000-V electrode boiler installation at the Manchester headquarters of the Tootal Broadhurst Lee Co.

The "move" complained of has extended to the United States, as is shown by the following extract from a report of the activities of the Industrial Commission of Wisconsin. "In connection with the work of the Wisconsin Industrial Commission in considering the proper way in which to revise the Wisconsin State Electrical Code, we have been at a loss to know just how to take care of the proper installation of electrical wiring in such places as barns in rural territories. In these territories it is not possible to secure an adequate and effective ground. The practice is to use a driven ground rod or pipe, and up to recently the practice has been to ground both the neutral wire of the system and also the metallic raceway or conduit to this grounding electrode. The 1931 edition of the National Electrical Code and also our State Electrical Code require that the neutral wire and the metallic raceway or conduit system shall be grounded independently to independent artificial electrodes, unless it is possible to ground to an extensive underground water-piping system. Experience indicates that with a system of this kind there may be failures of insulation on the secondary wires resulting in a metallic raceway or conduit system being at practically line voltage above ground. Quite a number of cases in which cows have been killed have been called to our attention and we are being urged to change our rules to permit the interconnection of the neutral wire and the raceway systems and the grounding to a common electrode."

Danger to Cattle

Further investigation of some of the cases mentioned above proved that the cows were not killed owing to failure of insulation, but because the second independent electrode to which the conduits and appliances had been earthed had been so placed *that it came within the area of a potential gradient due to the neutral electrode*, the interior installation being quite sound. In such circumstances the combining of the two electrodes will be of no benefit whatever, but rather the reverse, and the only real solution to the problem would be to keep all conduits, &c., clear of *all* earthing electrodes.

If American and Canadians are experiencing trouble by the killing of cows even on their comparatively low supply pressures (nearly all distribution is single-phase, three-wire, 115/230 V) how much more careful we in this country must be before we blindly adopt multiple earthed neutral distribution systems in rural areas, with our supply pressures of 230/400 V! Exactly the same trouble was experienced in the early days of rural extensions in Germany (220/380 V) when cattle and horses were killed with alarming frequency. It was found necessary to devise an entirely new form of protection in rural areas, and this exact form is now being studied in America and Canada, following its success in Germany.

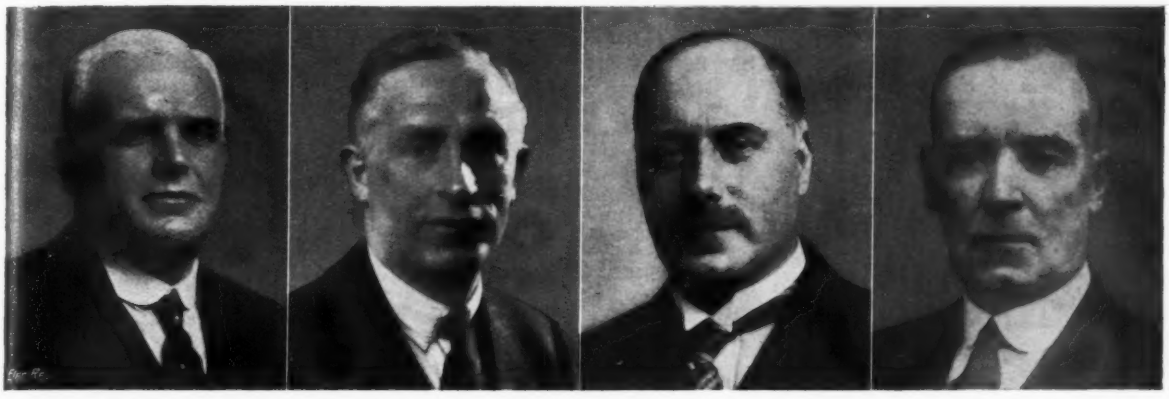
High-resistance Earth Troubles

Presumably the "readily correctable faults" referred to by Mr. Taylor include the bugbear of high-resistance earths in rural areas, but it is difficult to see in what way this trouble is correctable even at heavy expense. Many readers of an article on "Resistance to Earth of Grid Towers" (ELECTRICAL REVIEW, January 27th, 1933), must have been struck with the high values shown by the recorded tests. The driven-pipe or rod electrode usually employed on rural installations may possess any resistance between 50 and 200 ohms, whilst instances have been found of this rising to 400 ohms.

Nevertheless, I agree that multiple earthing possesses advantages that will probably lead to its adoption in this country, especially if the big supply interests back the demand. But no portion of the consumer's installation, conduit, wiring, or apparatus, must be connected to the neutral earthing electrode, but to other electrodes upon which the neutral electrode cannot possibly have any influence.

The adoption of multiple earthing will probably indicate that neutral copper has been cut to a minimum and the neutral breakages may be more common than at present. Also the possibility of contact between a phase line and multiple earthed neutral line opens up many questions, but would serve to emphasise the necessity of some such arrangement as has been described in this article being definitely adhered to in rural installations in this country. A leakage on apparatus or a neutral wiring can only affect a particular installation, but a contact between lines will affect a whole area.

Some Municipal Electrical Engineers



Members of the sub-committee of the I.M.E.A. Bulk Supply Committee. From left to right: Mr. A. W. Blake (*Elliott & Fry*), Willesden; Mr. F. Newey, Long Eaton; Mr. A. J. Hutchinson (*Lafayette*), Farnworth (chairman); and Mr. Price F. White, Bangor

Antimony Extraction by Electrolysis. By C. C. Downie

THE extraction of antimony from metallurgical products represents one of the most recent industrial applications of electrolysis. The most fruitful source of the raw material is the waste metallines, drosses, etc., recovered after the smelting of complex alloys. This coarse residue does not offer any scope for direct lixiviation; hence it is necessary to commence operations by preliminary smelting, the complexity of which has been reduced now that more suitable refractories are available for lining the furnaces.

Smelting converts the whole mass to sulphide and so renders the antimony content soluble. The metallic residues are ground and mixed with their own weight of coal dross, and three times their weight of salt cake. They are then charged on to the hot bed of a small reverberatory furnace and the temperature maintained at a dull red heat. The lining of the bed is composed of aluminous brick, which resists the usual penetrating influence of alkaline fluxes. As the mass melts it swells up and effervesces for some time, after which it settles and becomes quiescent.

The treatment converts practically all metal into a crude matte, usually black in colour, and very soft. It is tapped into pots, broken up with hammers, and in some instances allowed to weather in the open air. It has been objected that weathering causes the mass to crumble, which permits of simple pulverisation, whilst, alternatively, it impairs the solvent action of the excess sodium sulphide by oxidising it to sulphate. The feature of this method is that the antimony is converted to a soluble condition, whilst practically all the other metals remain as an insoluble residue.

The Method of Procedure

The black matte, being soft and friable, is easily ground to a fine powder in a pan mill. It is then sieved into an ordinary iron tank, boiled up with hot water, settled, and filtered, and the clear yellow liquor run through an open cloth with the aid of a syphon. The residue remaining in the tank consists of unburnt carbon, together with sulphides of copper, iron, lead, etc.

The electrolysis bath consists of an iron tank, or series of tanks. The cathodes are made from sheet iron, suitably cut and bolted on to rails at the top of the tank, whilst in some systems the iron sides of the tank also serve as cathodes, which is the most popular method, as the rails may rest directly on the rim of the bath, and thus require no insulation. To attain the maximum current efficiency in the latter instance, the tanks should be kept full throughout, and care taken that no earthing of the current is possible, otherwise appreciable current losses would be sustained in a manner unknown to ordinary receptacles, which themselves are insulators, or are supported by insulators.

The anodes consist of cast plates of lead, usually made from scrap lead, containing type metal and other antimonial alloys which confer hardness on the resulting metal, whereby a thin section of plate will maintain its rigidity throughout the operations. These plates are suspended from iron rails resting on strips which form the positive leads, which are isolated by resting on wooden blocks.

The preliminary manipulation usually gives many anxious moments to the operator, as sulphur tends to deposit in a most disconcerting manner until the correct conditions of oxidation, alkali concentration, temperature, and current density have been ascertained. Were it possible to secure a consistent composition of liquor from the smelting process, it would be possible to tabulate a form of definite regulations, but, unfortunately, in practice no such consistency appears. The sulphide liquors resulting from variations of working, or from decomposition, provide a variable electrolyte.

For reasons of economy it is undesirable to have to add sodium sulphide or sodium hydroxide, which is commonly employed in laboratory experimental work. As the same amount of antimony is deposited from sulphantimonates as from sulphantimonites, despite the difference in valency in the two compounds, it is desirable that the latter salt be produced as far as possible, since it ensures a very considerable saving in current. The electrolyte has, therefore, to be treated so as to allow the current to act most effectively. As the electrolyte is more or less kept stationary, the bath is principally depleted of its antimony at the bottom, and hence is fed in at the bottom.

Where several tanks are used, the rich electrolyte moves upwards in the bath, and the excess flows into the next tank by means of rubber tubing, which serves as an insulator, whilst a three-way cock is attached beneath the tanks which obviates the installation of different attachments. For ordinary works purposes, no attempt is made to form a strongly adherent deposit, and so long as the metal is removed by the current from the electrolyte, this is considered to be satisfactory. The deposit takes the form of powder or shining scales, depending on the current density employed, and is allowed to settle on the bottom of the tank, so long as it is not sufficiently appreciable to retard the flow of the ensuing current. The iron cathodes are then scraped down, the current disconnected, and the deposited metal removed.

Before the present improved system of electrolysis was introduced a crude deposit was obtained, which was composed of a mixture of antimony and sulphur. This was then subjected to an improvised wet concentration process which removed the large bulk of the light sulphur, but a sufficiency of this undesirable impurity always remained present to injure the quality of the antimony.

Resistance Difficulties

The resistance difficulties encountered in this work are probably unsurpassed in any other industrially applied electrolytic system, and much work remains to be done before the process can be regarded as an unqualified success. Records taken of the resistance set up show an almost continual variation, largely due to the decomposing nature of the electrolyte, and also the physical condition of the slimy deposit. The refining of the crude antimony by Betts' fluoride method, or the earlier ferric chloride methods, do not appear to have been applied to the foregoing process, and the deposited metal is mixed with a small proportion of flux, compressed into blocks by means of a hand-briquetting press, and melted in a kettle under a layer of grease or tallow.

Although numerous suggestions have been proposed for the reclamation of the spent electrolyte, they appear to have been too expensive to gain popularity, and there is no record of their being accepted. The feature of the foregoing process is that it applies industrially what for long was only regarded as an experimental process.

Tubular Busbars. By A. M. Spruce, A.Am.I.E.E.

Their deflection characteristics when applied to outdoor sub-stations

THE choice of conductor materials for tubular busbars and connections in outdoor sub-stations lies between copper, aluminium, steel, and the less frequent composite form. Each type has its advantages and limitations either electrically or when considered as a mechanically stressed beam due to external forces. Steel tubing, although strong mechanically, has poor conductivity (approximately 12 per cent. of copper) and can only be used where corrosion will not occur. For these reasons the copper clad steel, or composite, conductor has been developed in this country. The high conductivity copper, is so drawn on to a solid-drawn steel tube that there is everywhere the closest possible contact.

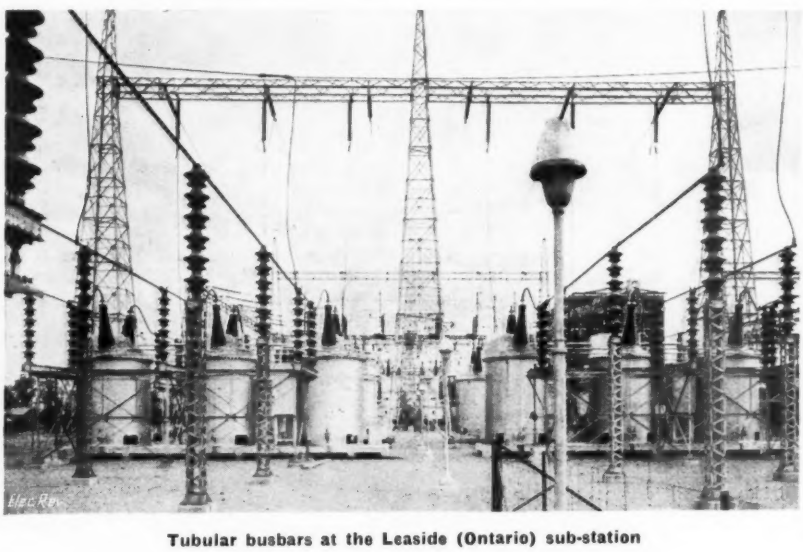
TABLE I.

PHYSICAL PROPERTIES OF MATERIALS.

Material.	Relative weight.	Modulus of Elasticity (E) lb. per sq. in.	Ultimate strength lb. per sq. in.	Safe skin stress lb. per sq. in.
Copper	1.0	15,000,000	55,000	15,000
Aluminium	0.307	10,000,000	10,000	10,000
Steel	0.89	30,000,000	60,000	24,000
Rolled copper	1.0	12,000,000	33,000	12,000

Under no-load conditions, the deflection of an aluminium tube will be less than that of a copper tube of the same size and span length, owing to its lower unit weight, but the ratio of the two deflections cannot be accurately compared unless their respective moduli of elasticity are taken into consideration. The ratio, E, for the two materials (table I) is three to two and the unit weight approximately one to three, giving a deflection ratio of one to two.

With the ice covered conductors, the deflection may be greater for aluminium than for copper; the size at which the change occurs depending upon the ratio of metal to ice volume. The minimum radial ice thickness is usually taken as ½ in., the figure specified by the Electricity Commissioners in El. C.53, 1928. In extremely cold climates copper is to be preferred. The size of tubing chosen for any specific case will generally be governed by span length, rather than by current-carrying capacity and temperature rise. On high-voltage stations the distance between insulator supports will be fairly large, and to reduce deflection to a minimum a large section tube must be chosen, which will also reduce corona losses. With flexible strained connections additional steelwork is necessary, and greater stresses are thrown on the main structure. This extra steelwork is eliminated when tubular conductors are employed.



Tubular busbars at the Leaside (Ontario) sub-station

Calculating the Deflection

The calculated deflection will be affected by variations in the physical properties of the metals and by the method of support fixing and the number of bus supports per run. The standard formula $\Delta = 5WL^3/384EI$, is correct for a simply supported beam across two supports with a total uniformly distributed load of W lb. Assuming a uniform radial ice thickness over the complete length, the load is the resultant of the vertical-tube dead load plus ice load and the horizontal wind pressure on the projected ice area. The deflection obtained by this formula will be the largest possible for any tube size.

When adjacent tube lengths are connected by couplers and supported by three or more insulator supports, the deflection is greatly reduced from the figures normally obtained. For example, the deflection of a continuous beam with two equal spans and a uniform load is given by $WL^3/185EI$, and is therefore only about 77/185 or 0.41 of a single-span deflection. With four or more insulator supports the centre spans may have deflections even less than 0.2 of the standard figures. It follows from the formulæ that to decrease deflection, which is inversely proportional to the sectional moment of inertia, a larger tube size must be used or the wall thickness decreased.

Skin Stress

The stresses that occur in the extreme outside fibres of the tube will usually be within the safe limits given in table I, providing the deflection is equal to its diameter or perhaps even up to three diameters. The maximum skin stress may be ascertained by finding the maximum bending moment on the tube under the worst conditions. If BM equals the bending moment, then the skin stress is given by $f = BM/Z$ lb. per sq. in., the bending moment for simply supported beams with two supports being found from $BM = WL/8$ inch lb. With a continuous busbar the tubular skin stress is somewhat lower than that for a single span.

When a tap-off connection is made to the busbars the connection forms a concentrated load. The extra bending moment and deflection thereby caused must be included if the connection weight is at all commensurable with the tubing weight. Entirely separate calculations may be made to obtain the deflection due to a combined uniformly distributed and concentrated load, the total deflection being approximately given by the sum of the two individual deflections. To obtain the deflection of a composite tube the approximate value of Young's modulus must first be computed. The method is perhaps best indicated by a typical example :—

Assume a composite tube 3 in. outside diameter by 0.156 in. thick, steel 11 s.w.g. = 0.116 in.; copper 19 s.w.g. = 0.04 in.; inertia = $0.0491\ (D^4 - d^4) = 0.0491\ (3^4 - 2.688^4) = 1.415$.

The weight per ft. of composite tube is 4.908 lb. and the weight W for a 25 ft. span is 122.6 lb.

Young's modulus is assumed to be in the same ratio as the thickness of the two tubes, *i.e.*, 0.04 to 0.116. Therefore $0.04 \times 12{,}000{,}000 / .156 = 3{,}076{,}800$, and $0.116 \times 30{,}000{,}000 / .156 = 22{,}311{,}000$, giving a total of 25,387,800 lb. per sq. inch. Maximum deflection $= 5WL^3/384EI = 1.172$ in. On actual test the deflection for a 25-ft. span supported for 2 in. at each end measured 13/16 in.

The composite type of tubular conductor has been used fairly extensively at certain of the 132-kV outdoor stations on the grid. The accompanying illustration shows a tubular bus run supported by post insulators mounted on auxiliary steel pedestals at the 220-kV Toronto-Leaside transforming station of the Hydro-Electric Power Commission of Ontario. The tubular conductors (20 ft. above ground) are of 2-in. copper tubing, with a maximum spacing of 24 ft. between supports.

TABLE II.

PROPERTIES OF TUBULAR CONDUCTORS.

Nom. size of tube. ins.	Diameter, in.		Weight per ft. run, lb.			Modulus of section Z.	Moment of inertia I.	Radius of gyration r.
	Outside D.	Inside d.	Copper.	Aluminium.	Steel			
¾	0.840	0.622	0.96	0.292	0.850	0.041	0.017	0.261
¾	1.050	0.824	1.30	0.390	1.130	0.071	0.037	0.334
1	1.343	1.049	1.90	0.590	1.750	0.150	0.100	0.426
1¼	1.688	1.380	2.80	0.800	2.300	0.258	0.218	0.545
1½	1.900	1.610	3.20	0.935	2.717	0.326	0.310	0.623
2	2.375	2.067	4.23	1.250	3.652	0.561	0.666	0.787
2½	3.000	2.469	6.14	2.001	5.793	1.427	2.140	0.971
3	3.500	3.068	8.75	2.617	7.575	1.724	3.017	1.164
3½	4.000	3.548	11.41	3.140	9.109	2.394	4.788	1.337
4	4.500	4.026	12.94	3.720	10.790	3.214	7.233	1.510

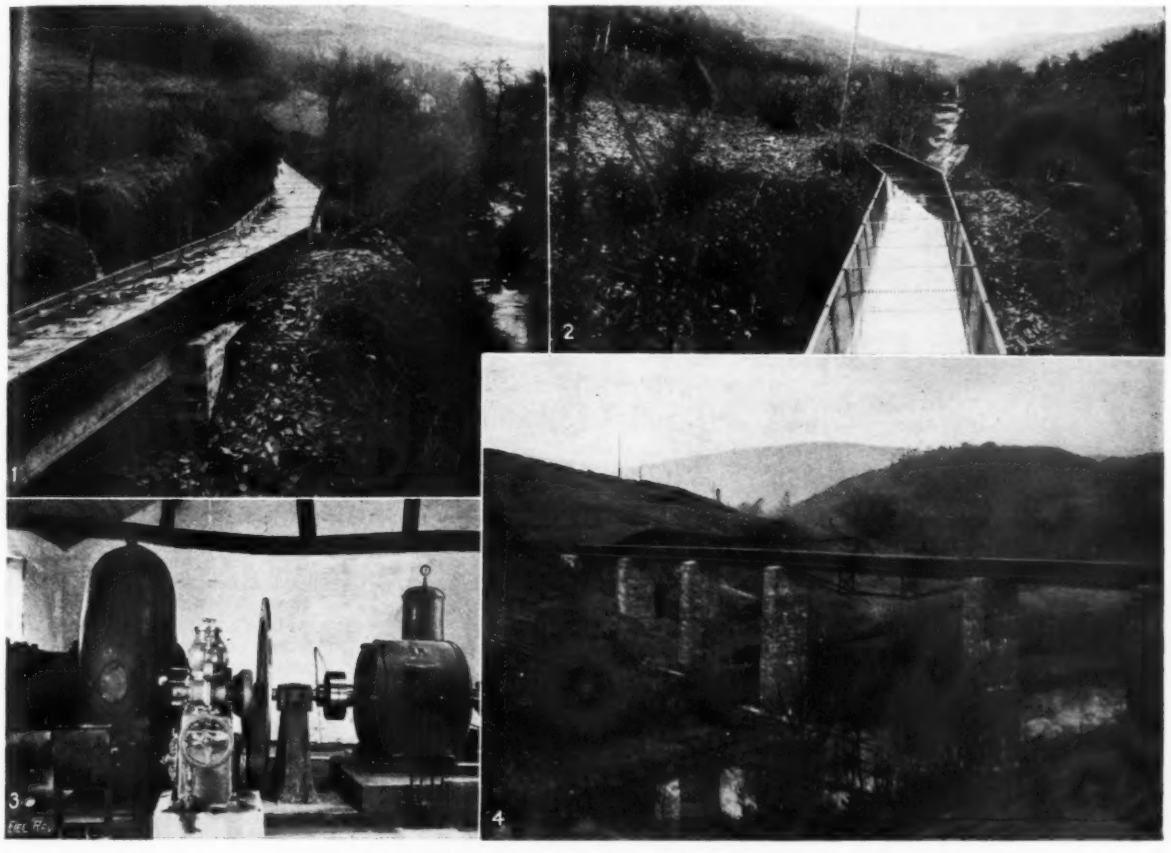
$I = 0.049\ (D^4 - d^4)$ in.^{4}; $Z = 2.1/D$ in.^{3}; $r = \sqrt{D^2 - d^2/i}$ in.; and area of annular section $= 0.7854\ (D^2 - d^2)$.

A Small Welsh Water Power Scheme

POWER for the recently inaugurated Machynlleth water-power station is derived from the River Dulas, about 1¼ miles from the town and a concrete dam 6 ft. high and 100 ft. long with three fish-pass pools has been constructed across the river. The power house contains a Gilkes & Gordon Francis-type spiral-cased turbine giving 110 h.p. at 500 r.p.m. when taking 1,850 cu. ft. of water per minute at a 40-ft. head. Speed regulation is by a Gilkes oil-pressure governor. The 66-kW (0.85 p.f.) 400-V Brush alternator is over-compounded by means of a rectifier. As standby, during drought, a Robey 100-h.p. oil engine and a 66-kW alternator have been installed.

Transmission is by a l.v. line to Forge Bridge (adjacent to the flume) and a 3.3-kV line to a sub-station near the centre of the town, whence four l.v. overhead distributors are taken. The houses are fed from the backs and underground cables are used for street crossings.

The schedule charges are 8d. per kWh for lighting and 3d. for heating and power, with a sliding scale for larger consumers. The company starts operations with sixty consumers and about 1,000 lights. The total cost of the work was £8,000, all subscribed locally. The engineer for the electrical and general features of the scheme was Mr. W. M. Harris, A.M.I.E.E., and for the hydraulic portion Mr. G. E. T. Thorpe, both directors of Gilbert Gilkes & Gordon, Ltd., who carried out the whole of the work, with Mr. Wm. Hughes as sub-contractor for the local construction.

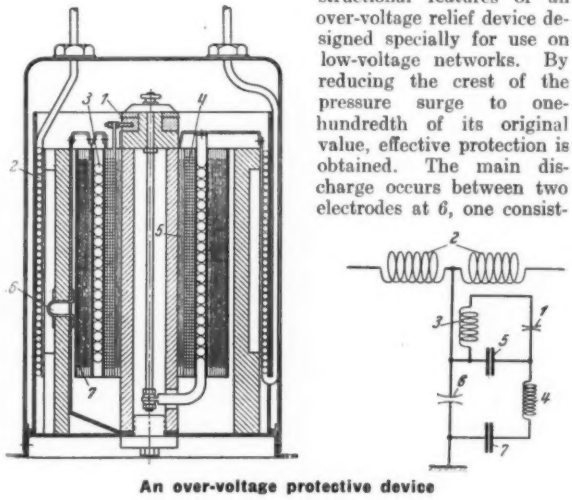


The Machynlleth Hydro-electric Works

1. The method of carrying the water to the power station. 2. Another view showing the construction of the troughing. 3. The 110-h.p. Gilkes turbine and 75-kVA Brush alternator. 4. The aqueduct across the River Dulas

Over-voltage Protection for L.V. Networks

THE accompanying illustrations, reproduced from *Elektrotechnische Zeitschrift*, show the circuit diagram and constructional features of an over-voltage relief device designed specially for use on low-voltage networks. By reducing the crest of the pressure surge to one-hundredth of its original value, effective protection is obtained. The main discharge occurs between two electrodes at *6*, one consisting of a tube of relatively large diameter connected to the line, the other consisting of a small ring with a hemispherical end. The axes of the two electrodes are at right angles, and the small electrode passes through a cylinder of incombustible insulation and is connected to an earthed metal cylinder. The distance between the two electrodes is maintained by collars on the insulating cylinder.



An over-voltage protective device

Two blow-out coils, *2*, are wound outside the tube electrode and connected to the latter at their common terminal. Although the apparatus is only about 4¾ in. in diameter, it is capable of interrupting up to 400 A at 380 V. The smallest distance between the electrodes should not be less than 1 mm., the gap at which the spark-over pressure amounts to approximately 3,500 V.

In order to obtain protection below this limit, a high-frequency oscillating circuit is arranged as shown. The coil *3* is magnetically coupled with one, *4*, of a considerably greater number of turns, connected in series with condensers *5*, *7*, and the main gap *6*. The auxiliary spark gap, *1*, is of the point and plate type. About eight-fold multiplication of voltage is provided by the oscillating circuit, so that the main gap discharges under primary impulses of the order of 500 V. The whole equipment is contained in a watertight casing with line and earth terminals. As built for a 25-A installation, the apparatus measures about 6½ in. by 4¾ in. diameter, and weighs about 7¾ lb.

A Private Plant in London

Diesels replace steam at the "Prudential" headquarters

ELECTRICITY for light, heat, and power for the Holborn Bars offices of the Prudential Assurance Co., Ltd., is all generated on the premises. This large building has recently been enlarged and the power plant has simultaneously been increased and changed over from steam to oil, while the voltage of the installation has been raised from 110 to 220 V. The main contractors for the power plant were Drake & Gorham, Ltd.

Five Diesel-electric sets have been installed, three of which will carry the normal load, with the fourth serving as a standby while the fifth is being overhauled. The engines are of the Davey Paxman six-cylinder, heavy-duty, spring-injection type, each of 300 b.h.p. at 650 r.p.m., with a 12-in. stroke, and a cylinder bore of 9 in., totally enclosed and forced lubricated.

Two Cambridge pyrometer outfits enable the exhaust temperature of each cylinder to be kept under observation. Kent fuel flowmeters are provided and the De Laval lubricating and fuel oil centrifugal purifiers are driven by "Bull" motors. English Electric motors drive the dirty lubricating oil pump and the two air compressors.

Waste-heat boilers recover heat from the engine exhausts and cylinder cooling water, assisting oil-fired steam boilers to provide hot water for heating the building and for domestic purposes. Two Pulsometer cooling water pumps and the two cooler spray pumps are driven by English Electric motors, as are the two motors driving the Pullen automatically controlled pumps for the "Becco" water softening plant, made by the Engineering & Chemical Co., Ltd. The five compound interpole d.c. generators are of English Electric make, each developing 200 kW at 230 V, having long commutators with six brush arms each in six sections.

A Large Standby Battery

A 230-V, 1,500-Ah, D.P. lead-acid battery forms a standby and carries the night and week-end loads. The normal discharge rate is 250 A and the maximum 780 A, or 180 kW, 90 per cent. of one generator output. The battery is charged in the mornings, when the generator load is light. There is an automatically controlled Lancashire Dynamo & Crypto motor-booster with an output of 440 to 156 A at 87 to 99 V. Voltage regulation is obtained by manipulating the sixteen end cells, which are kept charged by a small Crypto motor-generator of 250 A output at 2 to 3 V. The Electric Construction Co. supplied a 3.6-kW motor generator for charging a 60-V battery for the office telephone system.

The engine-room lighting (pendant globes) takes 7 kW and the auxiliaries over 35 kW, excluding the 60 kW needed for battery charging. All main pumps are in duplicate—one standby in each case. The main switchboards were built by Drake & Gorham, Ltd., with "Sindanyo" panels supplied by Turner's Asbestos Cement Co., Ferranti and Record instruments, and Whipp & Bourne circuit breakers.

The present maximum load of 415 kW will reach 600 kW when the new wing of the building is fully occupied. Messrs. F. H. Wheeler were the main contractors for wiring and fitting the new building, in which supplementary heating is provided by electric radiators, which were made up by Messrs. Wheeler to the design of the architects, Messrs. Joseph. Similarly some of the new lighting fittings were specially made by them and also Messrs. Heffer and the Merchant Adventurers, Ltd., while low-voltage low-temperature luminous tubes made by Maples, Ltd., are attached vertically to the walls of the cloak rooms.

Up-to-date Lighting

The illumination is particularly attractive, as the illustrations on page 479 show, and good use has been made of indirect lighting in appropriate rooms. For instance, in the large and small conference halls Siemens concealed trough reflectors are employed, while a circular anteroom has a "silver" ceiling and is lighted by six inverted Ediswan 100-W "X-ray" reflectors concealed in the top of a safe which stands in the centre. Siemens lamps are used throughout. Some 500 distribution boxes and 113 miles of conduit and cable have been installed in the new offices.

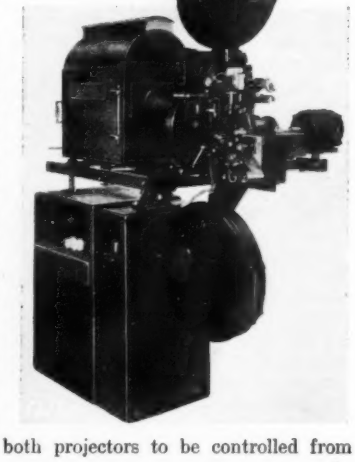
There are 350 electrically driven "Powers" machines for sorting, tabulating, cash recording, calculating, &c. Eighteen Waygood-Otis gearless passenger lifts are installed, of which nine are in the new wing. A "Synchronome" master clock controls 200 "slave" dials throughout the offices.

The strong room constructed by Chubb, Ltd., for the storage of securities is 48 ft. long, 38 ft. wide, and 10 ft. high. It is lighted by "Ediswan" cornice strip, installed by Messrs. Duncan Watson, and the inclined footway and overhead ventilating duct are folded back by a small Crypto motor (push-button operated, which automatically switches off the lighting simultaneously) when the main 28-ton door is closed.

Mr. F. P. North, the Prudential Co.'s electrical engineer, is to be congratulated on the smooth conversion of the plant with the minimum interference with the services.

Sound-film Equipment

A RANGE of complete sound-film equipments incorporating many novel features has been introduced by Philips Industrial, 145, Charing Cross Road, W.C.2. Neatness and freedom from complicated wiring are effected by including the whole of the amplifiers, &c., in the base supporting the projector. There are two models, "Minor" and "Major." The former can contain either a single channel 25-W amplifier or a single-channel 50-W amplifier, while the latter can accommodate single- or double-channel amplifiers up to 100 W. For large cinemas one amplifier is housed in the base supporting one projector and the other on the second base. Alternatively, the makers' oxide cathode projector arc rectifier can be housed in the second base. The model demonstrated to us had twin projectors mounted on a single "Major" base, a compact, economical and convenient arrangement enabling both projectors to be controlled from either side.



The Philips "Major" sound-film projection equipment

If required, other makes of projector can be fitted to the company's sound base. The standard sound head is of the "pull through" type, incorporating a constant-speed device. A sprocket wheel (turned by the passage of the film through the sound head) operates a cam which causes two contacts to close for a certain period during each revolution. The contacts short-circuit a resistance in series with the repulsion motor which drives the projector. When the spring-loaded "reaction roller," round which the film passes, is moved through its gate, it operates a lever which causes the distance between the two contacts to be increased, so that they do not close for a time during each revolution of the cam. When the speed of the film through the sound head increases, it pulls the reaction roller forward, and this causes the contacts to remain open for a longer period than is the case at normal speed. The series resistance is therefore in circuit for a longer period, so slowing down the motor to its original speed. The reverse movements take place when the speed of the machine decreases.

A special exciter lamp having a spring-loaded single-thread filament is projected through a reducing optical system on to the sound track, whence the light passes directly to the photo-electric cell. No slit is used, since the accurately focused filament provides in itself a narrow line of light, and by eliminating the usual slit very greatly increased light intensity is obtained. A notch in the edge of the flanged cap of the exciter lamp corresponds to a pin in the lamp housing, and correct location of the flange ensures automatic housing. The optical system also needs no adjustment, and is sealed to prevent alteration of the very fine adjustment. The vacuum photo-electric cell has a guaranteed sensitivity of 20 micro A/L, so that only three stages of amplification are needed between the photo-cell and the loud speakers.

On the "Major" model all the controls are grouped together at the top of the sound base and duplicated on the opposite side. Connecting spindles enable operation from either side. The internal wiring is readily accessible by opening the hinged panels at the sides. The apparatus has been carefully designed to avoid any possibility of vibration from the projector affecting the sound system, and there is no trace of microphonic ring. Field excitation for the loud speakers is provided by a rectifier built in the sound base, and the switching is such that it is impossible to put the pilot speaker into operation when the rectifier is "off."

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Marine Direction-finding Considerations

A WIRELESS direction finder that is free from ambiguity, which has been developed in H.M. Signal School for use in ships as well as on shore, is described in the paper which Messrs. C. E. Horton and C. Crampton read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 5th.

In most forms of direction finder it is customary to use a figure-of-eight reception characteristic for taking the direction, and afterwards, by a separate operation, to resolve the ambiguity. This second operation increases the time required for taking a bearing, and the main advantage is that the direction and sense are determined by a single operation.

The principle involved is a combination of a figure-of-eight reception characteristic with a cardioid under conditions which ensure (1) that the minimum of the cardioid is coincident in direction with one zero of the figure-of-eight, and (2) that the cardioid e.m.f. is in quadrature with that of the figure-of-eight. These conditions can be fairly easily satisfied for an instrument set up on shore, but special precautions are necessary when it is installed in a metal ship, owing to the effect of various parts of the ship and its rigging on the wireless wave.

Performance

An analysis is made of the magnetic forces in the wave in the vicinity of a ship and of the e.m.f. induced in the receiver of the instrument, and it is shown that in all cases where direction finding with simple apparatus is possible in a ship it is also possible to obtain a satisfactory performance from the new instrument. The deviations that would be expected in a typical Service ship with the new instrument are calculated.

By suitable arrangements of circuits the deviations that are experienced with the new instrument can be reduced to the same deviations as would be obtained with the equivalent simple direction finder in the same position; for example, with a fixed-spaced-aerial instrument all deviations could be removed as in the case of a Bellini-Tosi system. Methods for effecting these corrections in the new system are discussed. Finally, the setting up of the new instrument in a cruiser is described and an account of trials carried out, the results obtained, and a comparison with expected results, are given.

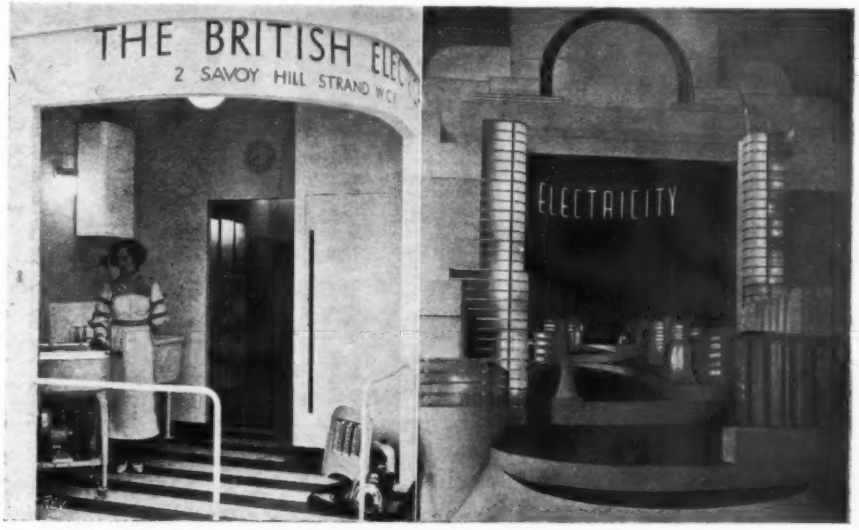
In another paper read the same evening Mr. J. F. Coales considers errors in ships' radio direction-finding calibrations due to the shape and orientation of the aerial of the transmitting station.

Errors and their Causes

Owing to the effect of the steel hull of a ship on the incoming wave a vertical magnetic field may, through re-radiation, cause errors in the observed bearing taken with a wireless direction finder. Experiments at sea have shown that in the case of calibrations carried out with a roof aerial, if the receiving ship is not in line with the roof, errors of 1 deg. or 2 deg. may arise if the roof is not symmetrical. The error, however, decreases rapidly with increasing distance from the transmitter, and also with increasing frequency.

The expressions for these errors are derived mathematically and it is shown that they are closely allied to the ordinary deviation due to "ship effect." The error should be most marked in the direction of the electric axis of the ship (that in which the deviation is zero, usually the fore-and-aft line) and non-existent at right angles to this.

The work was carried out in a light cruiser with one of H.M. destroyers as transmitting ship, and the paper was prepared in H.M. Signal School.



The E.D.A. stand and lighting display at the Ideal Home Exhibition, Olympia

Criticisms of Domestic Apparatus

AT a meeting of the London Local Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION held on March 28th, Mr. H. C. Gamble, area sales engineer to the Northmet Co., read a paper on the design of modern electrical domestic appliances from the supply undertaking's point of view, and made a large number of criticisms based on experience on the sales side with the intention of assisting the manufacturers.

It must be acknowledged, he said, that the present afforded the finest opportunity for supplying the public with satisfactory electrical goods. Prices were low and rates in many districts had been reduced to attractive levels. The public was ready and willing, and yet there were electrical goods on the market which, by their faulty design, must disappoint consumers in the long run. It was unfortunate that the manufacturer did not see any reason to consult the consumers' salesman; as a result obvious mistakes of five or ten years ago were still being perpetuated. A large amount of apparatus was brought into the repair shops of the Northmet Co. and long delays were often caused by the difficulty of getting spare parts and lack of standardisation. The position was being made even worse by the manner in which the large stores were selling shoddy foreign electrical apparatus at low prices without any regard to the question of obtaining spares. Consumers brought this apparatus to the supply company for repair and blamed the undertaking for what had happened.

All fuses should be mounted on the front of the cooker under or over the switches, with a spare fuse carrier. To go a step farther, a small and efficient circuit breaker could be obtained for a few shillings and fitted in the place of fuses. The plug-in type of element should be standardised by every manufacturer in the interests of quick service to the consumer, and greater cleanliness of design was necessary to avoid awkward corners which were difficult to get at. Similar comments were applied to utensils, and the hope was expressed that the result of the work of the recently appointed E.D.A. Committee would be to remove some of the obvious disadvantages referred to.

Faults in Design

Mr. Gamble complained of lack of intelligent practice in electric fire design. Recently, even with some well-known makes, it had been impossible to obtain new firebars for replacements for at least ten days. Bowl fires, he hoped, would be scrapped very soon; they were a danger, especially as they were so often used in bathrooms. With regard to irons, he asked manufacturers not to be too sparing with terminal pins and to make the connector so that it could be easily taken to pieces and the flexible quickly connected by the user.

Although the toaster was rapidly gaining ground, difficulty of cleaning had led many consumers to discard the toaster after a very short time. It should not be difficult to design a toaster with a removable element, contact being made by a sliding spring contact in the base. The element should be graduated so that toasting was even, and a small switch should be fitted in the frame.

Kettles with alleged safety devices, which increased the cost and weight, were the subject of delays when replacements were necessary. If the element must be protected, a simple cartridge fuse fixed in the connector was all that was necessary, but even this was an extravagance, all that was needed being a cheap high-loaded immersion heater type

A battery of powerful searchlights concentrated on a group of motor cyclists at the Lea Bridge "speedway" during the filming of "Britannia of Billingsgate" by British Gaumont

of element which could be easily and quickly replaced by a novice. The author expressed a preference for aluminium kettles rather than copper.

A foot switch on vacuum cleaners was recommended in preference to the switch in the handle, which meant taking the flexible near the hand, the switch being usually too small to be robust and not easily repairable. Metal handles should be discarded and a terminal block fixed outside the casing would make reconnection simple without taking the motor to pieces. Dustbags were not dustproof; a cheap material which could be easily "proofed" and thrown away after six months' use should be possible.

Simplified Washboilers Wanted

The majority of small immersion heaters on the market were badly designed, much too light in general construction, and top-heavy. The correct place for the element was at the bottom of the utensil. The washboiler must be made much more cheaply if there was to be competition with the gas boiler; all safety devices should be eliminated and the element should be clamped on the under-side as simply as possible for quick replacement.

Finally, Mr. Gamble urged the need for a greater degree of standardisation and simplicity, and expressed the hope that more would be heard of the proposal to form an Electrical Sales Development Association for such a body was badly needed at the present time.

The chairman (Mr. D. K. S. Porteous) said that an unkinkable flexible cable for domestic electrical apparatus had been available for some years, but he admitted that it was expensive.

Mr. J. S. Sarbutt suggested that some of the faults that had been referred to were due to manufacturers being compelled to keep down the cost of the article.

Mr. Barrett, a colleague of Mr. Gamble, confirmed what he had said. The great need of the moment was a greater degree of standardisation on general details which would not cramp design. Quite recently supply authorities had been combining to get prices down, and they were also getting out their own designs. There was a great need for much more co-operation.

Mr. W. J. Oswald quoted maintenance costs at Wimbledon. In 1926 the cost per annum per cooker was just over £1; it remained at about that figure for two years and then dropped to 15s. In 1930 it fell to 12s., in 1931 it fell farther to 10s. 7d., and in 1932 it was 9s. 6d.; at the present time it was 7s. For washboilers, the average maintenance figure was 1s. 6d. per annum; water heaters cost 1s. 8d., exclusive of defurring, which cost about 2s. per heater each time, which at Wimbledon was once every eighteen months. The maintenance of kettles on users' premises cost about 1s. 4d. per annum, including flex and connectors. The Wimbledon Electricity Department undertook the reconditioning of cookers and at a cost of about £4 a cooker could be given a further useful life of about five years.

The Flex Question

Mr. P. J. Morley recommended manufacturers to get together more instead of fighting each other so much. Why should fires have flexibles at all? Some form of socket arrangement would obviate the need for a flexible connection.

The author, in reply, said that there were nineteen makers of electric cookers in the country and only four of them put the fuses in an easily accessible position. Unkinkable cables were too expensive, but if every manufacturer agreed to use one type the cable makers would be able to produce it at the right price.

While agreeing that there had been great advances in cooker manufacture in recent years, he was inclined to think that the reason why Mr. Oswald had brought down the cost of maintenance was largely the fine repair organisation that had been developed at Wimbledon. Local retailers no longer sold gas appliances; it had all been taken out of their hands by the gas undertakings, and in the same way the sale and installation of domestic electrical appliances would have to be undertaken solely by the electricity supply undertaking. Certainly, small retail shops would have to be closed down, and all back street trading abolished if the consumer of electricity was to be rendered the best possible service and the industry generally was to advance.

The Manchester-Altrincham Railway Electrification

THE electrification of the Manchester South Junction and Altrincham railway is described in the paper by Lt.-Col. F. A. Cortez Leigh which was read at the Institution of Electrical Engineers in London on April 6th. This is a suburban line and the first passenger line in this country to be operated on the 1,500-V d.c. overhead system, which is considered likely to be the standard in the event of main-line conversion.

Detailed reference is made to special features of the equipment and the reasons that governed the selection of particular types. For instance, it was originally intended that the convertors should all be rotary, each comprising two 750-V machines permanently in series and fed from one transformer with two independent low-voltage windings. But to obtain experience one mercury-arc rectifier was installed. It is the first in this country to operate at 1,500 V for railway service. It has six phases with two anodes in parallel per secondary phase, with a solenoid-operated ignition anode and six excitation anodes. The vacuum seal is of the mercury type, which gives a positive and constant indication of the state of each joint. The main anodes are insulated and a water-cooled radiator is attached to each anode. The anode tips and anode screens are of graphite.

A bake-out equipment, consisting of a small transformer and a loading resistance, is installed. The vacuum in the tank has not yet been broken, but should this be necessary the loading resistance is available to enable the vacuum to be restored before the rectifier is put back into service. An internal heater has been provided, but the rectifier will carry full load even when starting from cold. The cooling water supply to the rectifier is controlled thermostatically to give a constant outlet temperature, but as the mercury pump operates continuously its cooling system is separate from that of the rectifier, and its water supply is adjusted by a manually operated regulating valve.

There are two three-unit sub-stations and Midworth remote control of one sub-station from the other has been used for the first time for this kind of duty. The pantographs are the first to use a curved pan, and the motors are the most powerful of any in use in this country, 328 h.p. at one-hour rating.

A six-coach train on the Manchester-Altrincham line

The capital expenditure totalled £564,700, including £15,200 for new stations; the rolling stock accounted for £311,500

The total was slightly lower than the estimate, and the revenue charges have been entirely satisfactory. In rush periods there are twelve trains per hour and in slack periods one every fifteen minutes. The length of electrified line is 8.75 miles with stations barely 0.75 mile apart. Multiple-unit trains are employed, one of which is illustrated on the preceding page. Some details of the rolling stock and line appeared in our issue of May 15th, 1931 (p. 827).

Alderman Walker Reports Progress

THE address which Ald. W. Walker (Central Electricity Board) delivered to the Manchester, Liverpool, and District Section of the INSTITUTE OF TRANSPORT on March 31st reviewed the progress made in giving effect to the national electricity scheme. He said it was estimated that in Great Britain there was still at least seven million h.p. of primary steam plant and upwards of three million kW of private electrical plant.

In the United States, industry took 77 per cent. of the total electricity sold, although 68 per cent. of the houses had all-electric service; in Germany industry took 82 per cent., whilst in this country the proportion was only 52 per cent., although only 30 per cent. of our houses were connected to public supplies, most of them for lighting only. The adoption of two-part tariffs was leading to more and more all-electric houses, with their heating and cooking loads which, owing to their diversity factors, were so much wanted by the electrical engineer. The use of electricity for supplying hot water in houses was now a practicable matter, possessing many advantages, and for this a special "off-peak" price was quoted.

Many large buildings were installing central heating systems, for which high-voltage electricity, thermostatically controlled, was used. The new reference library in Manchester would be an example of this system.

Although there had been a decline of 37,000,000 kWh in the sale of electricity for power purposes in 1931, there had been a great increase in the usage of current for lighting and general domestic purposes.

Directly or indirectly cotton was responsible for nearly half the total electric power requirements of the present North-Western Area scheme, and the estimate of future power sales by authorised undertakings in the area must be dependent to an important extent on the prospects of the cotton industry.

Ald. J. Scott, M.I.E.E., who is engineer and manager of several electricity supply undertakings, and, incidentally, Mayor of Bootle, said that he would have liked to have heard Ald. Walker touch on the Central Electricity Board's running costs. He had heard it said that the figure was 0.0003d. per kWh. He was responsible for advising on urban and rural electricity schemes, and it would not have been possible to deal with some districts without the grid, because it had resulted in a reduction in the bulk supply charge. In some small areas they had been able to so develop the load that the peak load occurred at 8.30 a.m. It was interesting to observe that with the development of electricity undertakings there had also been progress in the gas industry. He was convinced, however, that in the near future, even with prices as they were, electricity would forge ahead and gas would be left behind.

The new vehicle-actuated traffic control system in Trafalgar Square: Left: The Mayor of Westminster (Councillor the Rev. E. St. G. Schomberg) switching on the signals. Centre: The traffic held up outside the National Gallery. Right: A "close-up" of the signal lamps. **(See note on p. 505)**

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Modern Cinema Lighting

IN the paper by Messrs. R. C. Hall and L. Hough which was read in London on April 3rd before the SOCIETY OF ENGINEERS, methods of lighting, heating, and ventilating cinema theatres are considered. The various systems are compared and details of the correct figures are given in cases where public regulations are involved. Fire risk is touched upon and the means of dealing with such an emergency are suggested. The construction of the building, particularly with reference to sound reproduction, is carefully gone into and the members of the cinema staff with their various duties are brought into notice. The second part of the paper deals with the actual sound-reproducing equipment. A key plan of the layout is given and the various parts are described in order. The projectors, lamps, wiring, amplifier, loud speakers, screen, and other parts are fully discussed, and illustrations are given of the more important details. Diagrams are given of the light system for sound-on-film reproduction, as are also particulars of reproduction from sound-on-disc; the internal wiring of a typical 12½-W amplifier is shown and the speech is traced from the disc or film through the reproducing intermediate apparatus to the loud speakers, whence it issues as actual sound. A peep is taken into the future and comments are made on what may be expected to happen.

Small Motor Performance

The last informal meeting of the 1932-33 session of the INSTITUTION OF ELECTRICAL ENGINEERS in London on March 27th was devoted to a discussion on the performance of fractional horse-power motors.

Mr. A. N. D. Kerr introduced the subject, and, with the co-operation of British manufacturers, exhibited a representative collection of small motors and their parts and further illustrated his remarks by means of lantern slides. He referred to foreign practice, but in the main the subject was restricted to British practice as governed by B.S.I. Specification No. 170.

He said that small motors had such a rapidly growing variety of applications that their design was chiefly a matter of compromise, so that the range might be somewhat limited, but readily adapted to the largest number of services. With every desire to be accommodating, the manufacturers could not comply with all requests and at the same time keep the cost down to the figure obtainable with mass production. Small motors had inherent shortcomings which it was best to be quite open about, but intelligent co-operation between the manufacturer and the user would often achieve a great service to both.

The severest duty a small motor could be put to was refrigeration. Many a compressor had a definite pulsation which resulted in a considerable increase in brush wear, the brush current sometimes being 50 per cent. above the normal current of the motor. With regard to bearings, experience had shown that on small a.c. machines preference must be given to sleeve over ball bearings on the point of noise reduction.

Radio Receiver Control

A novelty described by the president, Prof. Henry Briggs, on behalf of its inventor, Mr. I. Williams, Wales, at the ROYAL SCOTTISH SOCIETY OF ARTS, Edinburgh, was a new system of control for wireless receiving apparatus, enabling all the adjustments—tuning, wave-length and volume—to be effected from a distance through the medium of driving wires contained in a small flexible metallic tube. All the knobs and the graduated wave scale are removed from the set and placed in a neat "operating box." With this box in his hand a person lying in bed or seated say, in an armchair, has full control over a set situated anywhere in the room.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

To What Purpose?

From time to time we are told in the Press (technical and otherwise) of the progress made by the Central Electricity Board. To date, this progress seems to be confined to raising some thirty-odd millions of capital, linking up super stations, and preparing to give supplies to small undertakings.

I, like many others, want to see the days of cheap electricity, but I cannot see how the C.E.B. is going to render any assistance in this respect. The large cities have had large economical power stations for a long time; the grid, therefore, will not assist consumers there. The smaller towns in which the power stations were reported to be inefficient due to low load factor are finding themselves in rather a quandary. Many of these undertakings have still to pay off moneys borrowed in recent years for extensions, and they now find themselves having to take a bulk supply, and, incidentally, borrow more money to change over from d.c. to a.c. Such undertakings cannot hope to give cheap supplies for years to come.

To achieve any measure of success, I consider that the C.E.B. should have powers to take over the rights of distribution in rural areas. Companies operating in such areas are usually of a backward nature, with high overhead charges and resultant terrific tariff charges. I would point out the following facts to the C.E.B. :—

You have created a temporary boom in the electrical manufacturing industry. You have effectively written *finis* to the production of small generating plant. You have caused a number of men to be displaced (some permanently) by giving bulk supplies. You have put up overhead lines all over the countryside—and we are all wondering to what purpose.

March 28th. INTERESTED.

In the Electrical Section of the Ideal Home Exhibition, Olympia, where a number of leading electrical concerns have well-arranged displays

Lancashire Power Progress: Correction

On page 442 of your current issue you refer to the progress of the Lancashire Electric Power Company and, in the last sentence, you state that the overall efficiency of the Kearsley station was further improved, the coal consumption per kWh delivered to the mains being 1.36 lb. as against 1.38 lb. for 1931.

There is a slight error here, as the figures which you have quoted refer to the overall consumption of the company's three stations; the actual figures for Kearsley are: Coal per kWh to feeders, 1.247 lb.; coal per kWh generated, 1.197 lb. The efficiency of the station on the basis of units generated was 23.7 per cent. CHARLES D. TAITE,

Director, Lancashire Electric Power Co.

Manchester, *April 1st.*

The Electrical Association for Women

I wish to express my disapproval of the methods and procedure adopted by our Electrical Association for Women without any personal reflection. In the first place, the new headquarters of the Association is referred to as being a great scheme for the benefit of members, but how many members can really afford to visit London and make use of the headquarters?

I have to-day received a circular from the Association convening a dinner at 5s. 6d. (plus £5 railway fare and the necessary accommodation), and I desire through the medium of your valuable paper to express the view that the Association is not of any assistance to members outside London. It will be interesting to have the opinions of provincial members and others as to the real benefits that daughters desirous of becoming demonstrators can obtain during this terrible depression.

I consider that provincial branches should move in the direction of affording facilities for the training of young members without inflicting hardships on parents. How many electrical supply undertakings in the North can be said to give the necessary facilities for the training of demonstrators who are the daughters of the ratepayers.

I also suggest that the Association should cease wasting time and money on social functions until the country resumes prosperity by the aid of electricity. MEMBER.

April 1st.

Domestic Fire Alarms

While I was struck by the variety and ingenuity of the many electrical devices displayed at the Ideal Home Exhibition I was surprised to find no installations of fire alarms. An "ideal home" would be still more ideal if the precaution of fitting some electrical alarm system were taken.

Everybody has a dread of fire, and would rather pay for a fire alarm than be roasted. Fire alarms should be a call to action for every contractor in the country. The "season" has ended and a slack time is coming, unless we do something about it. Let's do it quickly. I earn my living in the business and I feel that a new cry is needed. J. SCOTT.

London, W.11, *March 31st.*

A Wiring Regulations Guide

I should appreciate the courtesy of your columns to make it generally known that our stock of over 4,000 copies of the "Employés' Guide to the I.E.E. Wiring Regulations (Ninth Edition)" has now been exhausted, and in view of the advanced stage of preparation of the new Tenth Edition of the I.E.E. Regulations, it has been decided not to reprint our present edition of the "Guide."

Further orders for it cannot therefore be executed by us, but immediately the Tenth Edition of the Regulations is available, a new and improved "Guide" will receive attention by the Association and a general announcement will be made.

A. BRAMMER, *General Secretary*,
Association of Supervising Electrical Engineers.

London, W.C.1, *April 3rd.*

Wax Operated Switches

I have read with great interest the article by Mr. A. G. Bullen in your issue of February 3rd, and I think it just possible that my own efforts on somewhat similar lines may interest your readers. I have evolved a device consisting of two contacts dipping into a layer of mercury which is supported by a layer of wax in a glass tube. If held more or less vertical and heated up to a temperature of about 60 deg. C. the wax melts, the mercury drops down, and the contacts are separated.

My original idea was to use it for the protection of a.c. motors by fixing it in good thermal contact with the stator coils, and wiring it in series with the no-volt coil of the starter.

On investigation I find that the idea of using a thermally operated device in this way is by no means new, although the device itself does seem to be novel. In place of wax and mercury I tried using fusible alloy made up to melt at 60 deg. C., but I found that it took a much longer time to melt, owing, I suppose, to its greater heat capacity.

In connection with the wax fuses described in Mr. Bullen's article, it occurred to me that since the object in having the wax is to get what is virtually a conductor with a very low melting point, surely a fusible alloy such as the one I have described would serve the same purpose and be rather easier to make into a fusible wire with a definite calibration.

I think that my tube switch or a modification of it would work very well as a "bearingstat," or for any purpose for which thermostatic switches are now used and only expected to operate in an emergency. It can, of course, be made to "make" as well as "break" a circuit. B. Criddle.

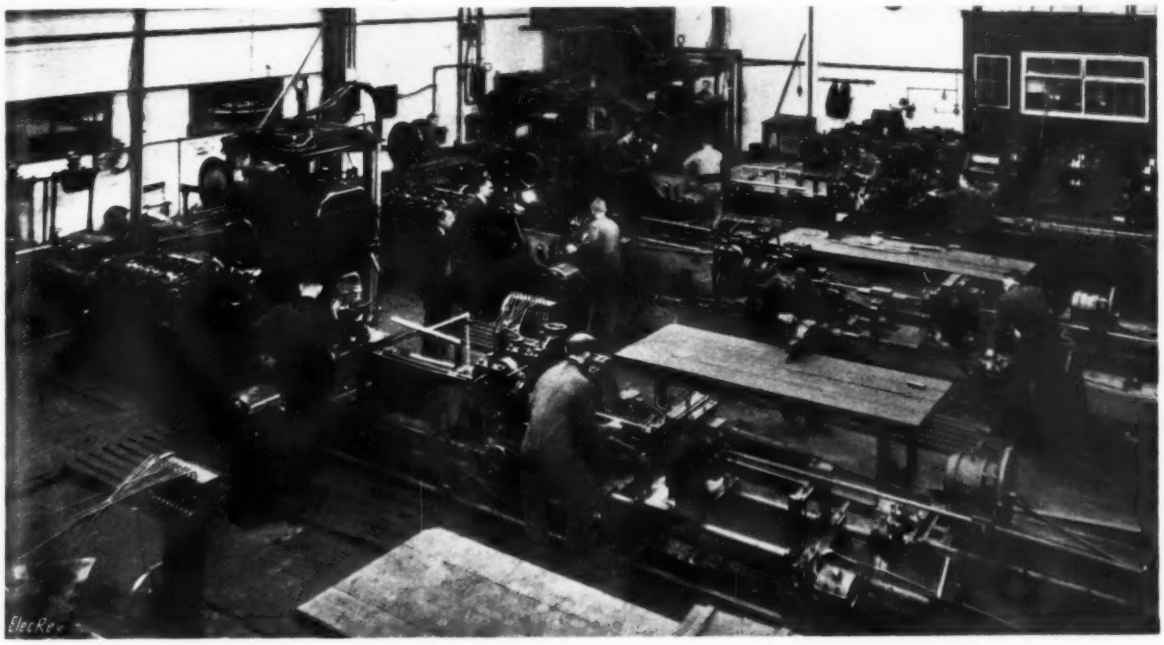
Formby, *April 3rd*.

Producing Welded Steel Tube

THE production of welded steel tube as we saw it recently at the Oldbury works of Tube Products, Ltd., is of dual interest to electrical men, first because of the increasing use of the product and secondly because the welding is done electrically.

The best quality British strip steel is purchased in 5-cwt. coils, which are joined by butt-welding and recoiled into units of at least one ton. Every coil is tested for hardness before joining up, and during the recoiling the metal is thoroughly cleaned.

The handling is entirely mechanical. From the large coils placed on horizontal turntables at ground level the strip is drawn directly on to the machine and first passed through shearing cutters to obtain the required width. Then, after going through a cleaning wad and guide wheels, and between vertical files in contact with the edges (an extra precaution to ensure the exact width), the sheet is carried through a series of sets of rolls which shape it into tubular form. Between the sets of rolls there are more cleaning wads.



Tube-welding machines from the discharge end

To ensure that the edges of the opening in the tube are absolutely upright and clean the tube passes, on its way to the next operation, welding, about guide file-knives inserted downward into the slit.

Resistance welding is employed, low voltage a.c. being supplied from a transformer embodied in the construction of the machine to the rotary copper electrodes *via* a multi-brush connection. The electrodes together present to the tube a surface similar to that of a grooved pulley to the driving rope, as the travelling tube makes contact with the electrodes above and pushes them round. Each electrode makes contact with the tube on one side of the slit, opposite to the point of contact of the other member, and the current flows across the resistance formed by the touching edges of the tube, so heating them up. Rolls acting on either side close the tube up while is it still hot.

The extraordinary working speed of upwards of 120 ft. per minute will give some idea of the welding achievement attained, the result of which is that the weld proper is ductile. The tube leaves the electrodes with a slight bulge of metal on top, and this is shaved off by a special cutting tool. The tube is next passed through a series of sizing rolls by which it is accurately shaped, and after being measured by a cyclometer arrangement it is cut off into lengths of 15 to 20 ft. while it is still in motion by a motor-driven saw unit, which travels with the tube whilst the cut is being made. It is brought back to its original position after each cut. A 5-h.p. motor driving the cutting saw and a 30-h.p. motor driving the forming, welding, and sizing units are the only motors on each machine. The machine motor drives through a magnetic clutch which is energised and de-energised for starting and stopping the machine. Interlocked with the clutch is a solenoid brake, and a master controller for the welding supply is also interlocked with the clutch, so that the electrodes can only be fed when the other parts of the machine are in operation. The voltage of the primary welding supply is maintained constant by an automatic induction regulator.

From each length of tube about 3 in. is cut. and subjected to a cone expansion test. Some of these test pieces are subjected to further exhaustive inspection in the laboratory. Each length from the machine is passed through straightening rolls and at the same time it is treated with anti-rust oil before being passed to stock. The lengths are next viewed for surface and tested for gauge and diameter.

From the long stock lengths shorter ones to customers' requirements are cut by batteries of motor-driven circular saws. Although the tube as produced can be easily bent, for special purposes customers can have their purchases annealed in the works. Shaping from the round to many varied sections is another production feature. For special purposes the small welding fin inside the tube can be removed by swaging or cold drawing. Any requirements as to curvature can also be met in the company's manipulation department. Tubes from ⅛ in. to 2¼ in. external diameter and from 22 to 14 s.w.g. are made.

Engineering on the Nile

A recently published brochure entitled "Engineering on the Nile" and dealing with the part played by the Engineering Department of Messrs. Thos. Cook & Son, Ltd., in the mechanical side of Egyptian life gives statistics regarding trade and agriculture which are of interest to anyone having commercial engineering interests in the country. Mr. T. A. Dixon, who for a number of years has held the position of director of the Technical Division of the State Domains Administration, has recently been appointed chief engineer of Messrs. Cook's Engineering Department at Boulac, near Cairo.

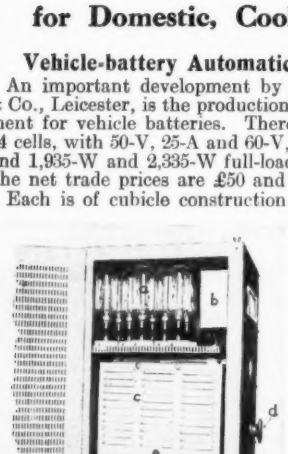
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Vehicle-battery Automatic Charging Equipment

An important development by MESSRS. PARTRIDGE, WILSON & Co., Leicester, is the production of automatic charging equipment for vehicle batteries. There are two models, for 20 and 24 cells, with 50-V, 25-A and 60-V, 25-A maximum d.c. outputs, and 1,935-W and 2,335-W full-load consumptions, respectively. The net trade prices are £50 and £55.

Each is of cubicle construction with angle steel framework and sheet steel covering, the panels being suitably perforated for ventilation. In the base is mounted the transformer and above this are the rectifying valves and control lamps. Opening the door gives immediate access to the automatic control box which can be detached by simply unscrewing four fixing screws and removing the connections from the connector block. A single knob on the front panel operates the mains switch, and above it is an opaque indicator panel. On pressing in the operating knob, with a vehicle battery on charge, the left-hand section of the indicator panel becomes illuminated in red with the words "Mains On." After a delay of eight to ten seconds, the automatic delay switch connects for the d.c. output and the words "Mains On" are replaced by "Charging" in green. At the completion of the charge an automatic cut-out operates and the mains switch is tripped by an impulse coil, thus switching off the rectifier. At the same time the right-hand section of the indicator panel becomes illuminated in blue with the words "Batteries Charged."



A "Davenset" automatic vehicle-battery charger with the door open

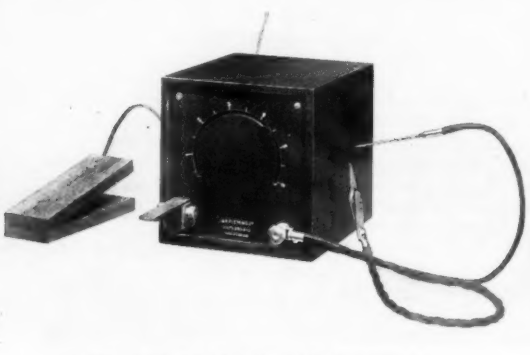
(a) Barretter control lamps; (b) indicator panel lamp box; (c) automatic control box; (d) mains switch operating knob; (e) control box connector block; (f) mains input connector; (g) transformer tapping connector; (h) d.c. output terminals.

In the event of the main rectifying valve failing during the operation of the instrument a spare valve is automatically switched into circuit, and in place of the word "Charging," "Caution, Emergency Valve Operating" appears in orange. The charge rate is automatically controlled at a figure not greater than 25 A, irrespective of the condition of the battery. The main operating switch is equipped with an automatic overload electro-magnetic release.

Soldering Silver and Gold

A machine known as the "Link" has recently been devised by which spectacle and eyeglass frames can be soldered electrically. It is manufactured by MESSRS. J. & R. FLEMING, LTD., 146, Clerkenwell Road, E.C.2, and costs £15.

With the old blow-pipe system of soldering the heat is not sufficiently localised, involving discoloration and loss of temper. It is then necessary to remove the marks of oxidisation by immersing the repaired article in a "pickle-bath" of dilute hydrochloric acid; the frame, if it has become very much softened, may even require to be hardened again. The new electrical method dispenses with this, as the heat is applied to a very small area only.



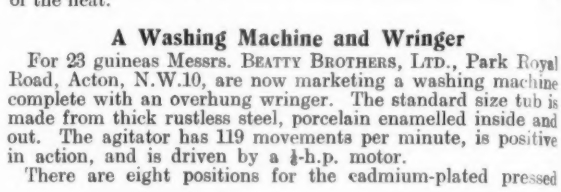
The "Link" electric soldering machine

The equipment provides a very compact means of butt welding, the ends of the wire forming the frames which are placed in circuit, the current being switched on and off by means of a foot lever so that both hands are left free, and there is no danger of shock as the instrument operates at a pressure of only 4 volts. Special tappings on the transformer allow variation of the heat.

A Washing Machine and Wringer

For 23 guineas Messrs. BEATTY BROTHERS, LTD., Park Royal Road, Acton, N.W.10, are now marketing a washing machine complete with an overhung wringer. The standard size tub is made from thick rustless steel, porcelain enamelled inside and out. The agitator has 119 movements per minute, is positive in action, and is driven by a ⅛-h.p. motor.

There are eight positions for the cadmium-plated pressed steel wringer, which has solid rubber rollers and runs at 44 r.p.m. A 26½-in. roll ironer, which can be supplied as an extra, fits on the wringer post just like the wringer. Reasons given for not equipping the machines for water heating are: The washing machine is too expensive an equipment to use as a water heater; water heating in such a machine is uneconomical; and the application of heat tends to dry out the bearings and gears.



The model "G" Beatty washing machine

A Small Thermal-storage Water Heater

The accompanying illustration shows the 1½-gal. "Quick-service" water heater recently introduced by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1. It is particularly suitable for all "over-the-basin" uses and for doctors, dentists, etc. Because the container is of tinned copper the water may be used for drinking purposes. Other features are an anti-drip device and improved lagging. The loading is 500 W and the price of the heater is £5 11s.

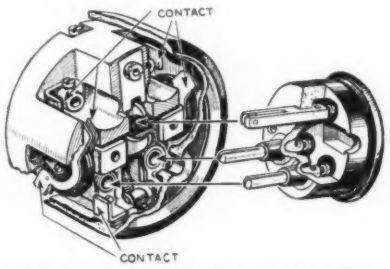
The Jackson 1½-gal. "Quickservice" water heater

An Automatic Switch-plug

The "H.B." switch-plug introduced by MESSRS. HENLEY BURROWS & Co., Hudsons Drive, Cotteridge, Birmingham, is designed with the object of making it impossible for any person to make contact with live metal, even with deliberate intent.

The current carrying pins on the plugs are insulated for a length proportionate to the stroke required to operate the interlocked d.p. switch, so that no live parts of these pins can become exposed before both poles of the switch are opened. Further, the circuit is always made and broken by the switch and not by the pins. When the switch is in the off position the socket contacts are completely isolated by a double break on each pole, and it is not possible to close the switch except by the specially shaped operating and earthing member carried by the plug.

The q.m. and b. switch mechanism is operated positively to the full "on" and "off" positions and is situated in a central groove in the base. The switch arms, each of which has two leaves of heavy-gauge phosphor bronze which embrace substantial fixed contacts, are mounted on either end of the spindle and similarly located in the base. When the cover is on, the grooves, by reason of abutments inside the cover, become separate chambers, and the opposite poles are completely isolated one from the other and from the operating mechanism.



Construction of the "H.B." switch-plug

By a special form of mica insulation it has been possible to eliminate trouble often associated with small bushed holes, and there is therefore no likelihood of a flash-over to earth. The actual breakdown voltage is 2,250 a.c., 50 cycles, and even then the insulation is not punctured; in fact when the earth is cleared and the fuses replaced, the switch-plug can be put into service again.

A test on an H.B. switch-plug by the Manchester electricity undertaking involved 30,000 makes and breaks at twenty operations per minute on full load, after which it was still operating effectively. Leeds undertaking conducted a test on the 10-A unit extending over twenty-three hours, commencing at 10 A and increasing the load to 15, 20, and 25 A. It was not until after the final three hours of the run at 25 A that the plug became hot. The ability to carry these heavy overloads is attributed to the careful adjustment of the switch contacts and to the construction of the tubular socket contacts which are formed and slit so as to ensure surface contact throughout the whole length of the pins.

The disc carrying the pins is arranged with grooves to accommodate the wire, instead of its being located in the cap. In the flush type there is no necessity to use a box, as the socket is completely enclosed in its own "Bakelite" cover, but it is not necessary to remove this cover for wiring, easy access to the terminals being provided.

The unit is made in three sizes, 5/7, 10, and 15/20 A, all available in surface, flush, "Bakelite," and ironclad patterns.

Two Low-priced Vacuum Cleaners

Two electric cleaners about to be introduced by the BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Parsons Green, S.W.6, clearly depict the trend of development. One is priced at 5 guineas and the other at 79s. 6d. The "Brownie" is an addition to the company's range of cylindrical models, making five in all, and the cheaper one, "Goblin Marvel," may be described as an "electric broom." The casing

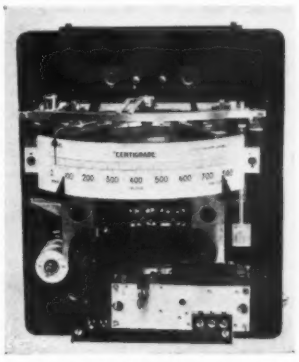
The new "Brownie" and "Goblin Marvel" cleaners

containing the internal dust bag and the motor are in line with the handle. Apart from the nozzle, there are two accessories only—a wide brush for use on floors and a round brush for dusting.

An Automatic Regulator

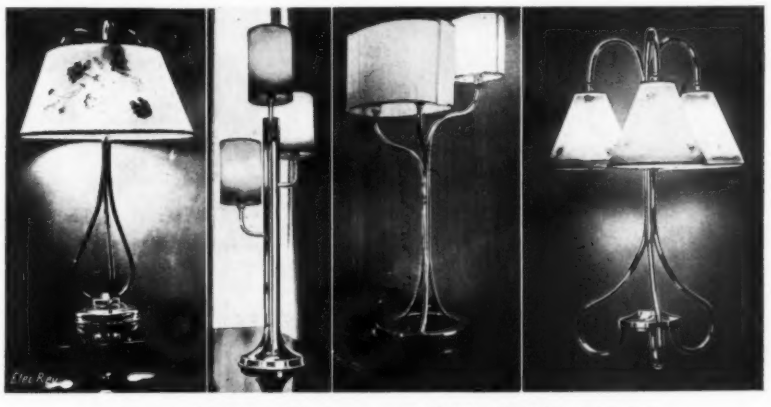
The following are major advantages pertaining to the Siemens automatic regulator for heat economy and control, etc., recently marketed by ELLIOT BROTHERS (LONDON), LTD., Century Works, Lewisham, London, S.E.13.

The regulator is available in single-moving coil and double-moving coil (cross coil) types. The former type may be calibrated for use with thermo-electric pyrometers, radiometers (total radiation pyrometers), and gas analysers. The cross-coil type may be calibrated in conjunction with a Wheatstone bridge for use with electrical distance thermometers, pressure and draught gauges, flow meters for steam, etc., and electrical humidity meters. The movement bears a pointer which indicates the readings, and also carries a small stem which moves over adjustable contacts on arms mounted concentrically with the coil system. The contacts will carry up to 50 VA at 110 or 220 V, a.c. or d.c. A chopper bar is actuated by an electro-magnet. At its "up" position the pointer is free to swing, but at regular intervals the electro-magnet is energised, pulling the chopper bar down and causing the small stem to press together one or other of the two pairs of contacts. The contacts are connected in the circuit of the control mechanism directly or through relays. Periodic operation of the electro-magnet and chopper bar is obtained by the opening and closing of a switch which is normally inside the case of the instrument.



Interior of the Siemens automatic regulator

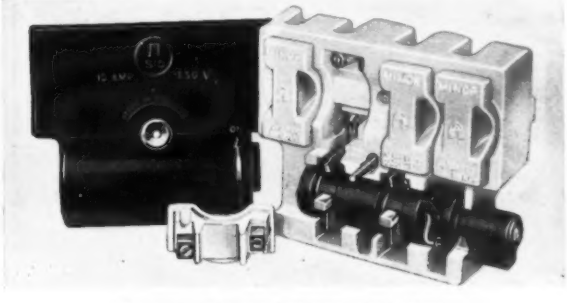
On a.c. this switch is operated by a small synchronous motor, and on d.c. an adjustable bi-metallic switch is employed. Upward or downward fluctuation tendencies may be indicated by signal lamps. For a number of equipments working through the same temperature range only one automatic regulator working with a multi-way automatic switch need be employed in conjunction with a Siemens programme transmitter. The regulator may be used for manufacturing processes where the temperature should be made to follow a specific time-temperature curve.



Four of the new table lamps marketed by Aladdin Industries, Aladdin Building, Greenford, Middlesex

All-insulated Switch Fuses

The wide range of "Bakelite" electrical accessories manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has been extended to include a new "Magnet" all-insulated double-pole 15-A switch-fuse, which is available in two patterns—double-pole switch-fuse (type "S.15") and the "splitter" model, known as type "S.10." Both are fitted with two double-pole fuses of the new "Minor" type, and are robust in design, having bases of solid English vitreous porcelain.



The new "Magnet S.10" switch-fuse

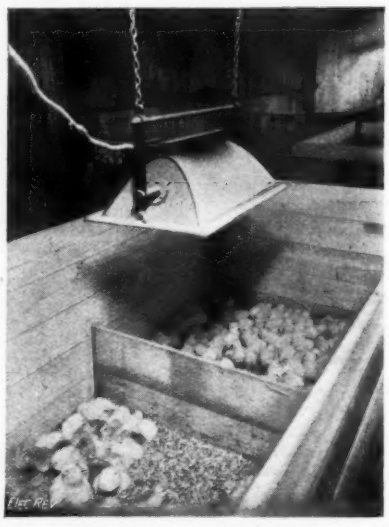
The switch is of the q.m. and b. type, incorporating substantial moving contacts which are mounted on an insulated "Bakelite" drum and engage with heavy phosphor-bronze

spring-fixed contacts, the moving contacts being self-aligning on each pole. The switch handle is of "Bakelite" and is flanged to engage with a projection on the moulded cover, thus preventing the cover being removed when the switch is in the "on" position. The prices are: Type "S.10," 6s. 8d.; type "S.15," 4s. 8d.

The Solution of the Brooder Problem

The Ferranti radiant fire has found a strikingly successful new application in connection with the brooding of chickens.

The brooding house of the usual poultry farm is a shed in which there are a number of box-like compartments, known as hovers, each heated with a small paraffin stove and containing up to, say, 150 chicks. The atmosphere within the enclosed hover is airless and stuffy, whilst the chicks crowding close round the stove frequently trample upon each other and injure themselves. Food is placed in the main shed outside, and since the heat from the stoves is more or less confined to the hovers, the air temperature of the main shed is often very low, and the chicks will not readily come out to feed; when they do come out, they frequently fail to find their way back and die of cold. One of the latest developments is a shed in which the hovers are a series of open compounds, the floors of which are flooded with radiant heat from brooder radiators suspended at a suitable height from the roof of the shed. The heat of the radiators is sufficient to impart warmth to the whole shed. The results achieved with this system of brooding have been very successful, and our illustration shows a compartment in a brooder shed in which 6,000 chicks are reared at one time under a battery of twenty 750-W brooder radiators made by Messrs. Ferrant, Ltd., Hollinwood, Lancs, at £3 2s. 6d. each.



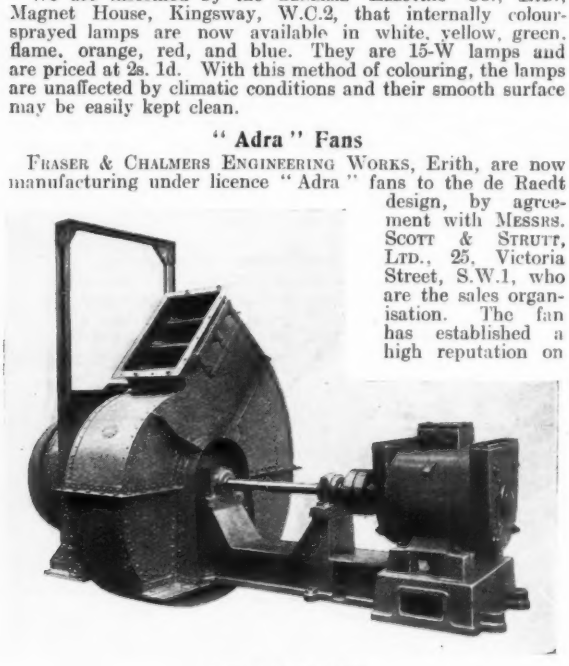
A Ferranti brooder radiator

Internally Colour-sprayed Lamps

We are informed by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, that internally colour-sprayed lamps are now available in white, yellow, green, flame, orange, red, and blue. They are 15-W lamps and are priced at 2s. 1d. With this method of colouring, the lamps are unaffected by climatic conditions and their smooth surface may be easily kept clean.

"Adra" Fans

Fraser & Chalmers Engineering Works, Erith, are now manufacturing under licence "Adra" fans to the de Raedt design, by agreement with Messrs. Scott & Strutt, Ltd., 25, Victoria Street, S.W.1, who are the sales organisation. The fan has established a high reputation on the Continent, particularly in the heavy industries, mining, metallurgy, power generation, &c.



The "Adra" fan

Among interesting features of this fan is a patent intake distributor, which is designed for use with fans handling dust-laden gas and air, pulverised fuel, &c., and has the effect of greatly prolonging the life of the fan runner and casing.

New Sign Lamps

Last week we inspected a new lamp for signs and displays, made in England by Messrs. Siemens Electric Lamp & Supplies, Ltd., 38, Upper Thames Street, E.C.4. Known as the "Dobrulux," it is filled with neon gas and the domed electrode is so constructed as to cause the slow discharge to move continuously with a gyratory movement round the dome, thus imparting life to the sign and attracting attention by its orange flaming appearance.

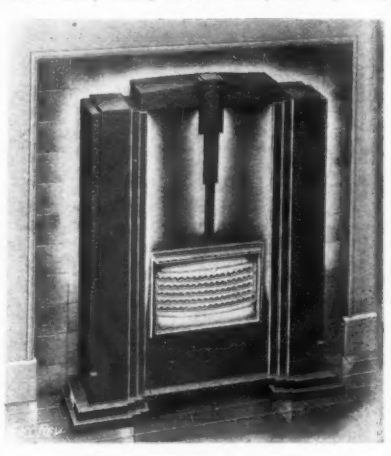
The "Dobrulux" sign lamp

Flashers or blinkers, which are liable to interfere with radio reception, are unnecessary and there is no filament, so that the lamp is not subject to mechanical breakage when it is being cleaned. The new lamp is 95 mm. long and 55 mm. in diameter; it is made with a screw or bayonet cap for 200/250 V d.c., a rectifier being necessary for a.c. use.

Although its list price is 5s., the "Dobrulux" is very economical, being rated at 0.5 W only. Thus a sign consisting of 100 ordinary 20-W lamps burning for 1,500 hours per year (from dusk to 11 p.m. daily) would consume 3,000 kWh, costing £25 at 2d. per kWh. With "Dobrulux" lamps, however, the consumption would be only 75 kWh, costing 12s. 6d.

Combined Convection and Radiant Heater

The "Raytonic" fire which is being manufactured by the Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, for the Raytonic Heating and Engineering Co., 118, Windsor House, Victoria Street, S.W.1, is designed to afford both radiant and convection heating. For the former there is recessed in the cast-iron frame a 1,000- or 1,500-W element behind which is a reflector. Convection is created by a 250-W lamp which projects heat downwards from the top of and inside the frame. There are slits in the frame at the angles, &c., and through these and openings in the back a pleasing glow effect is given. The equipment measures 30 in. high, 21½ in. wide, and 6 in. back to front, and costs 5 gns.

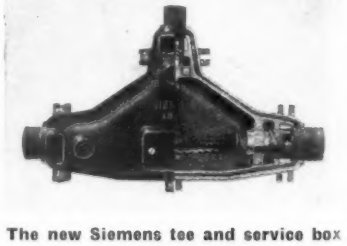


The "Raytonic" fire

An Improved Tee and Service Box

The improved tee and service box just placed on the market by Messrs. Siemens Brothers & Co., Ltd., Woolwich, entirely dispenses with the use of any form of outside clamps for securing the cable.

At each entrance inside the box is a conically shaped pocket for filling with molten lead, or solder, which moulds itself permanently around the cable (thus forming not only an internal clamp but also an efficient armour bond) and provides a good bearing surface. This feature is particularly important for wire-armoured cables that are subjected to ground subsidence, but in this case the armour wires should be fanned out before filling with metal. The scrap lead which is cut from the cable may be used for filling the pockets.



The new Siemens tee and service box

The assembly of the box has been very much simplified, as no loose parts in the form of top halves of clamps, extra bolts or cones are necessary to secure the armouring. If preferred, the pockets may be filled with compound instead of metal, as the cables are properly bonded by a light copper clamp which is attached to the box.

For the purpose of bonding the lead, tinned brass channel section clamps are fitted. A further advantage that is gained in the design of the box is that the outer protective covering of the cable is taken right into the box. Ample space has been allowed for connecting the cables, and the cover is provided with large size filling holes. All connecting screws are of brass and tinned.

Securing Export Orders.

By L. F. Ryland, B.Sc., A.M.I.E.E.

Present-day difficulties and methods of meeting them

WITH competition at home becoming increasingly keener in what is often, even in our electrical world, a shrinking market the manufacturer is forced to give greater attention to export. Immediately he finds himself up against a number of formidable obstacles.

First, there are the temporary limitations imposed in some countries on the export of currency which make it practically impossible for goods to be imported as these cannot be paid for, except over a long period, unless special permission from the Government is obtained. Countries with currencies depreciated to be comparable with sterling are largely closed markets to, say, an American or German manufacturer's products, unless the latter can be produced at exceptionally low prices or the manufacturer is prepared to sell without profit merely to keep his factory going. Very few overseas markets are free from tariffs, usually designed to encourage and protect local industry. Preferential rates for goods of British origin are admittedly of some benefit, but this advantage is often offset by the foreign competitor's lower labour charges.

What, then, can the individual manufacturer do to increase his volume of export business? Concerning what must now be regarded as "natural" barriers, he can do very little; only international action can be of much assistance. He can, however, make certain that his policy and organisation is the best possible in these difficult times of economies and reduced staffs. Furthermore, there must be no shadow of the "take it or leave it" spirit formerly attributed to many British manufacturers, but happily now seldom met with.

Selecting Agents

The question of the right type of foreign representation and the extent to which an agent is "primed" is of paramount importance. An overseas agent is primarily a salesman, just the same as a home representative. No manufacturer would fail to keep the latter up to date with information, both technical and commercial, yet this is not always so where an overseas agent is concerned. Unless the latter is similarly armed, maximum efficiency cannot be expected. In addition, lack of regularly mailed information means a frequent interchange of cables, with the consequent expense and delay. A certain amount of caution in circulating confidential information may be justified initially, but as soon as the agency has been got going on a sound basis there must be mutual confidence in this matter if substantial business is to result.

If possible, it is most desirable that an agent or members of his staff should regularly visit the factory, where details of construction and production can be discussed. This is much better than relying on catalogues and drawings alone, in addition to which valuable personal connections can be made, tending towards a better understanding.

If the manufacturer is new to the field he should, besides watching the technical Press, approach the Department of Overseas Trade for a schedule of firms in the territory in question who might be willing to consider a proposition; he can then pursue the matter farther himself. Apart from investigations as to financial standing, the manufacturer must ascertain whether the firm in view employs, or is prepared to obtain, suitable staff qualified to handle his commodities. If these are of a highly technical nature additional points must be considered. Has the agent had previous experience in this class of work? Can he take care of the erection of machinery, etc.? And what other manufacturers does he represent?

When an experienced firm of good standing has been chosen the manufacturer must be guided by its counsel in the matters of advertising and marketing of the goods, for English methods are often unsuitable abroad. Consignment stock is nearly always necessary unless the manufactures cover, for example, heavy plant, where installations differ widely and a standard article is the exception rather than the rule.

Assistance from the D.O.T.

An export inquiry may be received from a home source—a manufacturer who is perhaps quoting on a composite specification and does not himself manufacture all the gear required—or it may be advertised by British purchasing agents (this includes Government Departments), in which case tenders are usually submitted in London and a number of difficulties thereby eliminated. A third source is the manufacturer's own agent abroad, while a fourth alternative is for a specification issued abroad to be advertised in other countries. In this case it is usually possible to inspect or borrow a copy of the specification from the Department of Overseas Trade. This Department will, at trifling cost, regularly send brief particulars of most advertised specifications, thereby saving the manufacturer the trouble and expense of applying for copies of specifications which may, on inspection, be of no interest to him. Besides this, valuable information is furnished from time to time in such matters as foreign trade conditions, Government restrictions, revised tariffs, etc.

A specification from abroad is frequently more complex and detailed than an inquiry from the home market. Possibly this is due to a fear that on account of the great distance separating the purchaser from his source of supply a manufacturer may take a chance—on a loosely worded specification—of submitting a competitive price for supplies of indifferent quality. The failure of such supplies to stand up to service conditions may have serious consequences, and the contractor may be slow to remedy defects not specifically provided for by the guarantees in his contract.

It will often be found that the "Conditions of Contract," and more particularly the terms of payment, leave much to be desired from the point of view of the British manufacturer accustomed to I.E.E. and B.E.A.M.A. Conditions, but it is well to reflect that probably some twenty firms or so will make offers, half of these not British. In these circumstances, the manufacturer is not in such a strong position as in his own home market.

If the tender has to cover delivery to site, the questions of ocean freight, landing charges, customs duty, and foreign railage are all encountered, and in these matters many pitfalls await the unwary. An error of one ocean ton in a shipping estimate for South Africa may mean £5 in ocean freight alone, to say nothing of the additional charges to be met abroad. An error of this magnitude (quite easily made) in a £200 job can easily affect the placing of the order.

Compliance with Foreign Standards

Apart from the commercial aspect, an overseas specification often gives trouble on the technical side. In addition to calling for technical information not usually divulged to the home purchaser, the plant (if electrical) may have to comply with foreign standards, *e.g.*, those issued by the American Institute of Electrical Engineers or perhaps the German equivalent (V.D.E.). This frequently places the British manufacturer at a disadvantage, as a departure from British Standard Specifications frequently means an increase in manufacturing costs with no essential improvement in quality. It is, therefore, to be regretted that foreign importers cannot more often accept the standards of the exporting country. When an order has been secured, this should, of course, receive special attention from the first. If the contractor has been wise, he will have already inaugurated some system whereby his agent is able to furnish all the detailed information required along with the order itself, thus avoiding delay in completely putting the work in hand.

Should goods (*e.g.*, electrical plant) be so special that the system is unsuitable in this respect, it is a good plan (when there is a reasonable chance of an order being obtained) for a questionnaire to be sent to the agent *along with the tender*. A great deal of delay and confusion can be avoided by this simple precaution. Testing and inspecting of gear, when completed in the shops, must be even more thorough than usual, and if the purchaser is carrying out his own erection, then parts of the gear may require careful marking, bearing in mind that men, frequently natives, unacquainted with this type of machinery will most likely be employed. It is not possible, as at home, to send along a man to remedy some slight but important defect in a piece of machinery.

Care must be taken to avoid short shipments as these may mean many weeks' delay before the plant can be commissioned, and such carelessness is not infrequently rewarded by loss of future business.

Summer Thunderstorms

The annual record of thunderstorms occurring in the six summer months is being continued. Some of our readers have given valuable assistance in the observational work in the past, and others are asked to join in the census between April 1st and September 30th of this year. More data are particularly required from rural and moorland districts, and from thinly populated areas generally. Details are obtainable from Mr. S. Morris Bower, Thunderstorm Census Organisation, Huddersfield.

Parliamentary Notes

(BY OUR SPECIAL REPORTER)

SPECIAL Orders have been approved in respect of part of the rural district of Torrington, in the county of Devon; in respect of part of the borough of Walsall and part of the rural district of Walsall, in the county of Stafford; and in respect of the administrative county of the Isle of Wight.

Electricity Charges in Chelsea

On March 29th Mr. Todd asked the Minister of Transport whether his attention had been drawn to the high rate of electricity charges in the borough of Chelsea in comparison with charges in the neighbouring boroughs; and what steps he proposed to take to provide cheaper electricity for the public in the borough.

Mr. Stanley replied that the Chelsea Borough Council had communicated with him on the matter and intimated that they had requested the Chelsea Electricity Supply Co., Ltd., to consider favourably the question of a reduction of its present charges. His jurisdiction with regard to the revision of maximum prices did not arise until a formal application was made to him in accordance with the provisions of the Electricity (Supply) Acts.

L.N.E.R. Electrification

On March 29th Major Nathan asked the Minister of Transport whether he could state the position as to the projected electric railway from Liverpool Street *via* Bethnal Green to Ilford and beyond.

Mr. Stanley said that the railway company concerned had informed him that it had schemes of London suburban electrification under consideration and that when the London Passenger Transport Bill had become law it would be prepared to submit definite proposals to the Standing Joint Committee of the Transport Board which the Bill proposed to set up.

London Transport Bill Passed

In the House of Lords on March 30th the London Passenger Transport Bill was read a third time and passed. It has already been passed by the House of Commons.

In the Courts

IN the King's Bench Division on March 30th Mr. Justice Horridge had before him an action brought by Claude-General Neon Lights, Ltd., *v.* Kahn.

When the case was called on Counsel stated that, subject to his Lordship's sanction, the action had been settled on the terms that judgment would be entered for the plaintiff for £195 and costs, agreed at £75, and for a stay of execution on the terms endorsed on counsel's briefs.

His Lordship agreed to the terms.

Second-hand Lamps

In the Chancery Division on March 31st Mr. Justice Maugham had before him an action brought by the British Thomson-Houston Co., Ltd., the registered proprietors of the trade mark "Mazda" in respect of electric lamps, for an injunction (and ancillary relief) restraining Pryce's Stores, Fulham, S.W., from selling second-hand or used "Mazda" lamps as new lamps.

Another action which was heard at the same time was brought by the General Electric Co., Ltd., the registered proprietors of the trade mark "Osram" for an injunction (and ancillary relief) restraining the same defendants from selling second-hand "Osram" lamps as new lamps.

The defendants in each case denied that they had sold used lamps as new and unused. They said that the used lamps had been sold at a reduced price and that it was perfectly obvious to the customer in every case that lamps had been used.

At the conclusion of the evidence his Lordship, in giving judgment, said it was very natural that the plaintiffs should object to the sale of used or second-hand lamps. On the other hand, he did not think they had the right to object unless the trade was carried on dishonestly. So far as he could see it was not said that the lamps were new, but that they were "all right." The number of lamps the defendants had were trifling, seeing that they could not execute an order for a dozen "Osrams." Defendants said they had never suggested that the lamps were new, and he did not believe that the ordinary purchaser would think he was going to get perfectly new lamps.

In his opinion, the plaintiff, the General Electric Co., had failed to prove its case, and he dismissed the action, with costs. With regard to the action by the B.T.H. Co., in respect of "Mazda" lamps, he arrived at a similar conclusion, and also dismissed the action, with costs.

Mr. Winston Churchill Claims Trade Discount

Mr. Winston Churchill was sued at Westminster County Court last week by Messrs. Jackson & Boyce, electrical engineers, Berners Street, W., for £22 14s. 5d., balance of an account for work done and goods supplied to Mr. Churchill's flat at Morpeth Mansions, Victoria. Mr. Philip Pitt, barrister, for Mr. Churchill, applied that the matter should be referred to an expert referee as it involved technical questions. Mr. Churchill was advised by his architect that he had not only fully paid, but had overpaid. The contract price was £222 14s. 5d., and Mr. Churchill had paid £200. The whole matter had to be investigated, and should go back to an independent architect as it was highly technical.

Mr. A. E. Beecroft, for Messrs. Jackson & Boyce, opposed the application, stating that there was no reference to any items or allegation of negligence. Mr. Pitt ought to have said what items he objected to and if there was any cause for reference. Mr. Churchill's architect asked his clients to allow Mr. Churchill a trade discount of twenty-five per cent., but they refused. They were entitled to keep twenty-five per cent. as being their own discount. If not, it would mean that Mr. Churchill was being treated as a wholesaler and not as a retailer. There were only four items in dispute in a very long account in which a question of principle and not merely of account was involved.

Judge Dumas said that without the consent of both parties he did not believe he had the power to refer the matter to an arbitrator. Mr. Pitt said that the particulars in question could be supplied. The judge said that he would like to see in writing full particulars of the defence before he dealt with the application. If full particulars were supplied within a week he would deal with the application.

Mr. Pitt undertook to do so, and Judge Dumas said he would reserve the costs in the application.

The Eastbourne Contracts Case

THE proceedings taken by the Public Prosecutor following on the recent inquiry by the Eastbourne Corporation regarding certain electrical contracts opened at Eastbourne Police Court on Tuesday last, when there appeared as dependants the Pirelli-General Cable Works, Ltd.; Mr. Macartney Reed, an official of the company; Richard Spencer Chatfield, until recently an alderman of the Council, chairman of the Electricity Committee and of the Contracts Sub-Committee; and David Wm. Arthur Roberts, formerly deputy electrical engineer to the Corporation.

The company was charged with corruptly supplying Chatfield, as chairman of the Electricity Committee, with the use of a motor car between January 1st, 1930, and November 30th, 1931, as an inducement to him to show favour in connection with contracts for the electrification of the district contrary to the Prevention of Corrupt Practices Acts, 1906-1916; and further with supplying him with sums of money with the same intent. The company was also accused of giving various sums of money to Roberts as well as an estimate, schedule of prices, and letters, defective in material particulars and calculated to mislead.

Reed was accused in connection with these documents. Chatfield and Roberts were accused of accepting the gifts aforementioned, and Roberts further with using the said letters and schedules knowing them to be defective and misleading. Finally, all were alleged to have conspired together to commit offences against the Corrupt Practices Acts. It was agreed that all the cases should be taken together, and all the defendants elected to be tried by a jury.

Counsel comprised: For the company, Sir Patrick Hastings, K.C., Mr. St. John Hutchinson, and Mr. J. M. Symmons; for Macartney Reed, Sir H. Curtis Bennett and Mr. L. A. Byrne; for Roberts, Mr. John Flowers, K.C., and Mr. Derek Curtis Bennett; and for Chatfield, Mr. G. D. Roberts.

Mr. J. D. Cassells and Mr. Gerald Dodson appeared for the Public Prosecutor, and the former occupied the morning with his opening speech, in which he showed that contracts had been placed with the Pirelli-General Company amounting to £37,680, mostly on a non-competitive basis. He contended, in effect, that these were obtained through the influence of Roberts, and that a resident engineer and contracts clerk were sent down to Eastbourne with instructions to make themselves generally agreeable to important members of the Committee, the officials, and their families, and to dispense hospitality. In the end the accounts showed that £153 was spent in entertainment and £436 in cash payments.

As a result of certain interviews, the local representatives of the company were dismissed, but were afterwards offered reinstatement for a definite period at higher salaries on the ground that they had been treated with undue harshness in being made to bear the whole blame. They were not in a position to accept, and were given equivalent compensation, one receiving £684 and the other £351. Meanwhile information had been given to the Borough electrical engineer, Mr. J. K. Brydges, who consulted the Town Clerk. The Council applied to the company for an explanation of the alleged irregularities, and the reply was that, if these existed, they were due to excess of zeal on the part of the company's representatives.

Following counsel's speech evidence was formally taken, and the Court adjourned. It was anticipated that the hearing would last until to-day (Friday).

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The Moscow Arrests and the Trade Agreement

A number of important developments have taken place during the past few days in connection with the arrest of the Metropolitan-Vickers Electrical Co.'s employés in Moscow on charges of sabotage. On Sunday Sir Esmond Ovey, British Ambassador in Moscow, who was summoned by the Government for consultation, arrived home, and on Monday the Prime Minister announced in the House of Commons that a Bill would be presented on the following day to take powers to deal with the importation of Russian goods into this country. The Bill was to be passed through all its stages on Wednesday with a view to its becoming law at the earliest possible moment; the existing trade agreement with Russia lapses on April 17th. Meanwhile Mr. Allan Monkhouse, the Metrovick Co.'s chief representative in Moscow, and Mr. Charles Nordwall, one of his colleagues, have been formally charged with "military and economic espionage, damaging activities and bribery and counter-revolutionary propaganda." They, as well as the other arrested members of the Metrovick Moscow staff, Messrs. Thornton, MacDonald, Cushny, and Gregory, will stand for trial next Sunday in the Supreme Court composed of M. Ulrich (member of the Supreme Court), Professor Martens (director of the Diesel Institute), and M. Dimitrieff (director of the Thermo-Projecting Trust). Messrs. Thornton, Cushny, and Gregory have now been released on bail, but the company's offer of bail on behalf of Mr. MacDonald has not yet been accepted.

A White Paper was issued on Tuesday covering correspondence between March 12th and 17th relating to the arrests. In telegrams to Sir John Simon, Sir Esmond Ovey stated that the company had always been meticulously correct in its behaviour and had even purposely avoided contact with the Embassy rather than otherwise. It was inconceivable that the Soviet Government could produce credible evidence of any criminal malpractice on the part of the company, but it was possible that there might be some minor question of insignificant *douceurs*, tipping, or presents, which might consequently be distorted into bribery.

During the course of his examinations, Mr. Monkhouse was forced to sign a statement that he was engaged in what the examiners contended was espionage, but added a note to the effect that his action was taken only in the interests of his firm. A list was produced of twenty-five turbines supplied by the company which had given trouble. This he admitted was true. Fault lay partly with Russians themselves, but it was also true technical mistakes had been made by the company. Machines supplied were not of standard type, but generally represented some new technical development insisted upon by the Russians themselves. It was natural that there should occasionally be mishaps. The company had, however, in every case taken rapid action to repair them. Sir Esmond stated later that the principal danger of the situation would seem to be that the Russians are completely unable to see themselves in any other light than that of an aggrieved Power struggling for their noble ideals against a world of political, financial, and commercial conspirators. There was a complete lack of comprehension in Moscow of how serious the affair was considered in England.

Liverpool Electro-harmonic Society

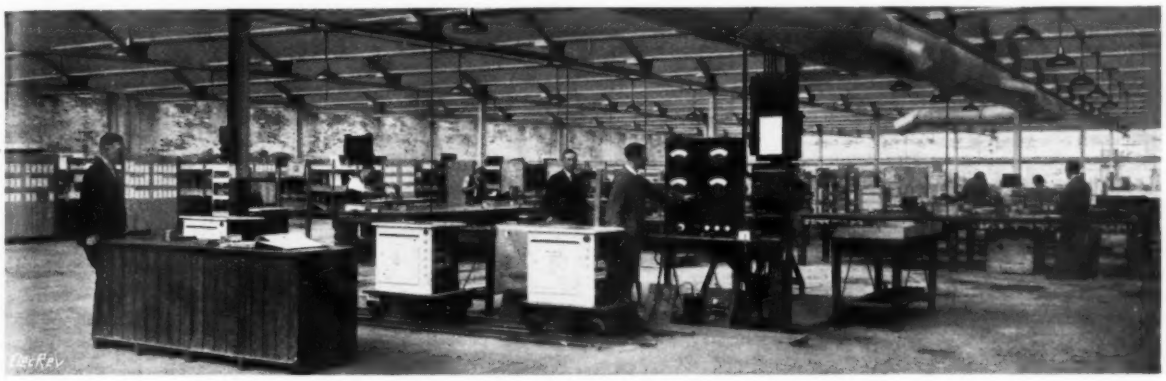
The Liverpool Electro-Harmonic Society entertained members of the Manchester Electro-Harmonic Society at a dinner and smoking concert at the Carlton Restaurant, Liverpool, on March 24th. Responding to the toast to the visitors, proposed by the chairman (Mr. C. P. Gregg), Mr. H. A. Pryor (Siemens Electric Lamps & Supplies, Ltd.) said the electrical age would come, and those engaged in the industry were bound to benefit. One of the best things that could happen was for members to get together socially and help to promote the spirit of friendship.

Trading in Southern Rhodesia

A confidential memorandum on the methods of trading, terms of payment, appointment of agents, &c., in Southern Rhodesia, has been issued by the Department of Overseas Trade to firms whose names are entered on its Special Register. United Kingdom firms wishing to obtain copies should apply to the Department, 35, Old Queen Street, S.W.1, quoting reference No. C.X.4098.

Messrs. Moffat's Progress

Messrs. Moffat, Ltd., the Canadian company which a few months ago commenced manufacturing electric cookers and equipment at Blackburn, is making good progress. The accompanying illustration shows a portion of the company's premises, from which it will be seen that the cookers are moved about on runners fixed in the concrete floor.



A section of the Blackburn factory of Messrs. Moffat, Ltd.

The B.E.A.M.A. Dinner

Lord Derby, the president, is to preside at the annual dinner of the British Electrical and Allied Manufacturers' Association to be held at the Connaught Rooms, W.C., on May 18th.

Blackburn Meadows

Referring to the description of the new Blackburn Meadows power station of the Sheffield Corporation electricity undertaking in our issue of March 24th, Messrs. James Gordon & Co., Ltd., state that an "Igema" distance water level indicator has been fitted to each of the three boilers installed.

Equipment for Animating Displays

The "Sinterae" lighting unit recently introduced by Mr. Leslie G. Toplis, 7, Princes Street, Westminster, S.W.1, is a device for creating the appearance of animation in advertising displays. Two sources of constant light (usually gasfilled lamps) are fixed rigidly in a container, and immediately in front of them are two apertures. Between these apertures and the lamps is a rotating shutter with only one aperture corresponding in size to those in the container, so that as the shutter is rotated the light is allowed to pass through only one container aperture at a time. The angle of the light projected on the object is thus constantly changing, and with it

A window display utilising a "Sinterae" unit

shadows cast by the object under the influence of the light. The result is akin to vibration.

The intensity of animation can be varied by supplementing the lighting from the "Sinterae" with floodlighting. The effect can also be varied to extreme intensity by altering the angle of projection in relation to the object. Projection upon a reflective surface produces a "sparkle" effect.

The particularly interesting application of this unit illustrated was seen at the London office of the British Thomson-Houston Co., Ltd., Crown House, Aldwych.

A Richardsons, Westgarth Development

In our issue of November 25th last we recorded the formation of Richardsons, Westgarth-Brown, Boveri, Ltd. We are informed by the new company that this is a development of the long association in the steam turbine field which has existed between Richardsons, Westgarth & Co., Ltd., and Brown, Boveri & Co., of Baden, Switzerland. Additional licences have been acquired from the Swiss company for the manufacture of turbo compressors and blowers for all purposes, including those for Diesel and aeroplane engines; main and exhaust steam marine propelling machinery, either with mechanical or electrical transmission; equipment for marine Diesel-electric propelling machinery; and auxiliary turbines for all purposes for use on board ship. Richardsons, Westgarth are therefore now in a position to manufacture such machinery at their Hartlepool works to Brown, Boveri designs, in addition to the steam turbines and electric generators previously made there. Close co-operation between the two concerns is assured, first by the recent appointment to the board of Richardsons, Westgarth of Mr. Adolph Meyer, technical director of the steam turbine works at Baden, and, secondly, by the formation of the new company. The latter will be responsible for all sales in Great Britain of the Brown, Boveri and other allied products of the Hartlepool concern. The chairman of the subsidiary company is Mr. R. S. Middleton, chairman of Richardsons, Westgarth & Co., the other directors being Mr. M. G. S. Swallow, Mr. S. V. Brown (Brown, Boveri & Co.), Mr. A. C. Eborall, and Mr. R. Vedoz. The registered address is Hartlepool Engine Works, Hartlepool, the London office being at 56, Victoria Street, S.W.1.

Even and adequate illumination in a printers' composing room

Bournemouth Electrical Contractors

The annual dinner of the Bournemouth branch of the Electrical Contractors' Association was held on March 31st, Mr. A. R. Wilson, chairman of the branch, presiding. Mr. Wilson, proposing the toast of "The County Borough of Bournemouth," claimed that the Association was a great asset to the town. The Mayor of Bournemouth (Councillor J. R. Edgecombe), responding, mentioned that trolley buses were to be experimented with in Bournemouth shortly. Mr. J. Y. Fletcher, of the General Electric Co., Ltd., proposed "The Electrical Contractors' Association." He deprecated the fact that there were contractors outside the Association. He said he had been thirty-eight years in the electrical industry and had seen many unsettled and unfavourable periods, but he believed that all sections of the industry were working towards greater stabilisation in all directions. In his view, the contractor and the manufacturer did not get close enough together in producing marketing plans for electrical commodities. He advocated a joint standing committee between the contractors and those groups of manufacturers with whom they had trading arrangements so that a more intensive marketing programme might be arranged. Mr. W. B. Williams, president of the Association, urged all sections of the industry to get together. Mr. L. C. Penwill, director and secretary, and Mr. H. H. Shears, vice-chairman and secretary of the Bournemouth branch, also spoke.

Conditions in Sweden

According to the *Swedish Economic Review*, commercial and industrial life in Sweden suffered increasingly last year from the general depression, intensified by the results of the Kreuger crash, which was felt particularly on the capital market and in the banking world. Neverless, the country's powers of resistance still proved to be great, which may be ascribed in some measure to the favourable effects of the depreciation of the Swedish krona. Exports continue to decline, shipments of electrical machinery last year amounting to only 17,749,000 kr. in value, as against 24,069,000 kr. in 1931. Telephone and telegraph apparatus exports were more than halved, falling from 14,963,000 to 7,123,000 kr.

The Metrovick Calendar

In its "girl" calendar for April, 1933-March, 1934, the Metropolitan-Vickers Electrical Co., Ltd., has departed from its black and white series, and the present study is printed by the colour gravure process. The subject is Miss Phyllis Stanley, who appeared as the Nun in "The Miracle."

Printing Works Lighting

In the large printing works of Goddard, Walker & Brown, Ltd., of Hull, the whole of the lighting has been carried out on direct lines. The installation consists of eighty-four G.E.C. dispersive steel reflectors equipped with "Osram" lamps. "Britalux" fittings are used for lighting the offices and "Magnet Silverlac" conduit and accessories, as well as Pirelli-General cable, were used by the contractors, the Accumulator Charging Co., Wincolmlee, Hull, the architects being Messrs. Blackmore Sykes & Co., Scale Lane, Hull. In the compositors' room reflectors are spaced at seven feet intervals and the resultant illumination is of the order of 19 ft.-candles on the working plane. The general works are illuminated to a lower intensity, but test readings have proved quite satisfactory with the reflectors spaced at 12-ft. intervals, the intensity being 12 ft.-candles. While the light is well distributed, there is an entire absence of disagreeable glare or dazzle, as the cut-off of the reflectors effectively prevents any bright light obstructing the line of vision.

E.D.A. South-Midland Area Luncheon

The annual luncheon and general meeting of the South-Midland Area of the British Electrical Development Association was held on Monday at the Midland Hotel, Birmingham, under the chairmanship of Mr. E. J. Jennings, of Birmingham. At the luncheon Mr. F. Forrest, Birmingham city electrical engineer, in proposing the toast of "The Association," stated that it was a matter for satisfaction that the electrical industry was able to report steady progress. Last year sales of electricity in Birmingham showed an advance of twelve per cent., and he entertained the hope that the city would take the first place among municipally owned undertakings in this country. The question of price reduction must be contingent upon increased consumption, for no further substantial improvements were in sight with regard to efficiency of generation. The toast was replied to by Mr. A. E. McKenzie, of Wimbledon, who congratulated Birmingham and the South Midlands district upon the progress made during the past year. This progress, he said, had been made largely on the industrial side, and the results were a happy augury of what might be expected when trade revival came. The domestic load was worthy of more attention than it had hitherto received. The report of the South-Midland Area Committee was approved on the motion of Mr. E. J. Jennings, who emphasised that the success of E.D.A. propaganda depended upon co-operative effort. He hoped all sections of the industry within the area would combine for that purpose.

Electrical Production in Canada

Compared with 1930 there was a decrease of $22,999,195 in the value of electrical equipment produced by firms in the electrical apparatus and supplies industry in Canada during 1931, according to figures published by the Dominion Bureau of Statistics, the total production being valued at $81,578,595.

For the purpose of compiling these statistics the industry is taken to include all concerns in Canada engaged primarily in the manufacture of equipment for use in the generation, transmission, and utilisation of electricity. In 1931 there were 163 factories in this group—124 in Ontario, nineteen in Quebec, eight in British Columbia, seven in Manitoba, four in Alberta, and one in Nova Scotia. These plants represented fixed and working capital of $100,057,945, and employed a monthly average of 18,207 people throughout the year. A total of $22,474,319 was spent in salaries and wages and $32,385,342 was paid out in purchased materials. In addition to the above electrical equipment valued at $18,888,481 was manufactured as a minor product by concerns classified under other groups of the Census of Industry.

Electrical imports into Canada were valued at $16,775,208 in 1931, as compared with $30,281,152 in the previous year. Included in the total for 1931 were: Radio apparatus, $4,784,512; electric motors, $1,913,264; telephone apparatus, $1,515,102; switches and switchboards, $960,124; lighting fittings, $825,000; batteries, $575,570; and transformers and parts, $528,040.

Included among the exports (valued at $1,343,132) were cooking and heating apparatus, $545,971; sparking plugs,

$244,122; telephone, telegraph and radio apparatus, $145,427; and batteries, $185,280.

Below are given a few of the more important items produced in Canada in 1931 with their selling values at works :—

	Value ($)
Vacuum cleaners and parts	3,378,123
Electric washing machines	6,510,378
Electrical conduit	1,233,014
Batteries	5,016,980
Electric generators	4,376,405
Electric motors (excluding starting motors)	3,401,627
Meters and instruments	1,150,700
Incandescent lamps	4,699,258
Lighting fittings	1,512,913
Radio apparatus (excluding valves)	18,555,710
Radio valves	2,298,098
Electric refrigerators	2,788,917
Switchgear and protective equipment (except telephone switchboards)	3,933,258
Telephone materials	7,396,505
Transformers	4,982,976
Electric cables and wire (except aluminium)	10,196,160

Social Events

The accompanying illustration shows a scene from "Murder on the Second Floor," which was given by the Dramatic and Operatic Society of the Metrovick Co. in Manchester last week. The presentation was well received by large audiences, and we understand that the acting was so realistic that during one performance, in the scene in which the Indian and the policeman crash through the bannisters to the floor below, the policeman was distinctly worse for his fall!

We have received from Mr. F. W. Leake, manager for India of British Insulated Cables, Ltd., Calcutta, particulars of a golf match played recently at the Royal Calcutta Golf Club between the Calcutta Electric Supply Corporation and a team representing various electric cable manufacturing companies in Calcutta. The Supply Corporation won both the singles and the foursomes, the matches being closely contested. The Corporation was represented by Messrs. F. T. Homan, F. W. Acheson, D. H. P. Henderson, C. Rowe, S. J. Harrison, L. Price, H. R. McKie, W. L. Price, J. Richardson, E. H. Dunsford, J. H. Waters, and K. G. Sillar, and the cable companies by Messrs. F. W. Leake, E. Thomas, H. S. Harris, T. G. Gunnis, D. J. McIntosh, D. R. Stanley, C. M. Shaw, C. Cormack, C. A. Maguire, F. H. Pilchar, M. D. Dixon, and G. Morgan.

The Dramatic Society of the General Electric Co., Ltd., which annually comes to the aid of the Infants' Hospital, Westminster, has this year given two performances of the popular comedy "Leave it to Psmith," by Ian Hay and P. G. Wodehouse, which was presented at the Fortune Theatre on Monday and Tuesday last. As Major J. H. Beith (Ian Hay), who was present on Tuesday, said, the play was a difficult one to produce, and great credit was due to the Society for the excellent performances given. A long and excellent cast made the most of the many humorous situations which this play affords, and deserved the enthusiastic reception accorded by large audiences. All the seats were sold, and the Infants' Hospital should benefit substantially as a result.

Staff dances are usually delightfully informal functions, and the staff dance of the Western Area of the North Metropolitan Electric Power Supply Co., which was held on Friday last at the Imperial Hotel, Russell Square, was especially so. Nearly three hundred members and friends were present, and obviously enjoyed a pleasant evening, which was enlivened by the distribution of novelties, including powder boxes for the ladies, provided by Messrs. Falk, Stadelmann & Co., and mirrors, supplied by Philips Lamps, Ltd. Mr. P. A. Thorogood, who organised the function and acted as M.C., fully deserved the ovation accorded him.

A Sign for Charging Depôts

The double-sided electric shop sign illustrated has recently been introduced by Messrs. Partridge Wilson & Co., Leicester, for use at "Davenset" battery-charging depôts. It is supplied complete with internal wiring, but without lamps, at 58s. 6d. net trade price. The shield-fashioned lamp box is constructed of rustless lead-coated sheet steel, whilst the sign glasses, backed by white opal glass, are stained by the "double fired-in" process to prevent fading in bright sunlight. The interior is white enamelled and wired from a very accessible terminal connector to three points fitted with porcelain lampholders. The bracket design is made from steel, heavily galvanised before it is finally painted black and silver.

The "Davenset" electric shop sign

Recent Contracts

A Chloride emergency lighting system has recently been installed at the Garrick Theatre, Southport.

The Birmingham Corporation has provisionally ordered from the General Electric Co., Ltd., fifty trolley-bus chassis required for the replacement of the trams on its Coventry Road route. Definite confirmation of the order, however, is held in abeyance until after the Budget is introduced, so that the Corporation may be in a position to decide whether any alteration to the taxation on passenger road vehicles is likely to penalise this class of vehicle.

Messrs. C. A. Parsons & Co., Ltd., have received from the Electricity Commission of South Africa an order for another 20,000-kW turbo-alternator and condensing plant for the Congella power station. This will be the fourth unit of the same size and type to be installed at Congella. The company has also received a repeat order for a 20,000-kW unit for the Calcutta Electric Supply Corporation. Both machines will develop their output at 3,000 r.p.m. in a single cylinder.

Trade Announcements

The Marconiphone Special Products Branch (including the Public Address Department) formerly situated at 21, City Road, E.C.2, has now been taken over by the Marconiphone Co., Ltd., and will in future operate from 210, Tottenham Court Road, W.1.

"Murder on the Second Floor"

Messrs. Falk, Stadelmann & Co., Ltd., have opened a depôt at 4, Dillwyn Street, Swansea (telephone, Swansea 5442), under the management of Mr. S. N. Trott.

Messrs. G. Dikkers & Co. (England), Ltd., have transferred their London offices to new premises at Abbey Works, Mount Pleasant, Wembley, Middlesex (telephone : Wembley 5127).

Messrs. E. W. Bliss Co., 40, Pocock Street, Blackfriars Road, S.E.1, have entered into an agreement with Messrs. Vickers-Armstrongs, Ltd., for the manufacture of their presses for the production of automobile bodies and parts, automatic can-making machinery, and other special tools.

Bulgarian Tariff Reductions

The Treaty of Commerce and Navigation between Germany and Bulgaria came into force provisionally on February 17th. According to the *Board of Trade Journal*, the reduced customs duties applicable to goods imported from countries (including the United Kingdom) enjoying most-favoured-nation treatment include the following :—

	Former. Gold leva per 100 kg.	Revised. Gold leva per 100 kg.
Electric dynamos and parts thereof weighing each from 12 to 25 kg. inclusive	100	50
Electrical apparatus and parts thereof.		
(*b*) For weighing, counting and registering, *e.g.*, electrometers, ammeters, voltmeters, indicators and the like	300	200
(*c*) For heating :—		
(1) Stoves, irons and heating plates	200	100
(2) Others	600	300
(*d*) Other (excluding telephone and telegraph apparatus) :—		
(1) Electrical, surgical and other medical instruments and parts thereof.	300	100
(2) Other kinds	300	150
Wires, electric current conductors, wound with spun materials (except silk or non-textile materials)	120	100

Prices of Materials

Messrs. F. Smith & Co. report, April 5th :—Electrolytic copper bars and sheets, no change. Electrolytic copper wire rods, £42 10s., 10s. dec. Electrolytic copper h.c. wire, 6¼d., ⅛d. dec. Silicium bronze, 8d., ¼d. dec.

Messrs. Edward Till & Co. report, April 5th : India-rubber, Para fine, no change.

Messrs. James & Shakespeare report, April 5th : No change in the prices of copper bars (best selected), sheet and rod and English pig lead.

For Sale

An X-ray outfit is offered for sale by Bedford County Hospital.

Londonderry Electricity Department has generating plant, &c., for disposal.

Generating and auxiliary plant is offered for disposal by Newport Electricity Department.

Barking Electricity Department has d.c. meters, scrap metal, switchgear, &c., for sale.

(See our classified advertisements.)

New Catalogues and Lists

Claude Lyons, Ltd., 40, Buckingham Gate, S.W.1.—A revised edition of "Ohm's Law Without Tears," an illustrated booklet giving a quantity of technical and practical information on resistances. Also a general catalogue of the company's radio products.

Lissen, Ltd., Worple Road, Isleworth, Middlesex.—An illustrated leaflet on the "Lissen" intermediate-frequency bandpass transformer.

Vessco, Ltd., 11, Red Lion Square, W.C.1.—A leaflet showing a metal-lined "Bakelite" heat and light adaptor with separate switches for each arm.

Best & Lloyd, Ltd., Handsworth, Birmingham.—Publication No. 185, dealing with theatre and cinema lighting installations and fittings.

Floodlighting & Fittings, Ltd., 294, Gray's Inn Road, W.C.1.—Leaflets giving details of "Flood" projectors and floodlights.

Magnacore, Ltd., 57, James Street, N.W.1.—A leaflet on quiescent push-pull amplification.

Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, W.1.—A bulletin of the company's latest products in tools and equipment.

George Ellison, Ltd., Perry Barr, Birmingham.—Lists Nos. 20, 25, and 71, dealing respectively with air-break flameproof gate-end circuit breakers, oil-break loom switches, and slip-ring motor control panels with air-cooled starters.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Publications on switchgear, air-break switches, fuses, distribution boxes, discount adjustments, &c.

Veritys, Ltd., Aston, Birmingham.—A booklet describing the "Metesco" link or fuse disconnecting box.

Scotoid Co., Ltd., Bowyer Street, Birmingham.—A leaflet giving particulars of a new all-British electric waffle mould.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Leaflets Nos. 925 and 1080, describing respectively hand-operated and self-acting starters.

Switchgear & Equipment, Ltd., Delavox Works, Banbury.—A leaflet on the company's pull-down switch-fuse for horizontal or vertical mounting.

Mek-elek Engineering, Ltd., 57, Victoria Street, S.W.1.—An illustrated leaflet showing the "Mek-elek" lamp for wall, bedrail or table use.

S. Bill & Co., Ltd., Queen's Road, Birmingham.—A leaflet giving particulars of the new "Botrade" 30-A all-insulated switch and fuse.

Leda Electric, Ltd., Nelson Street, Miles Platting, Manchester.—A leaflet dealing with the Leda refrigerator.

Bankruptcy Proceedings

C. Marquis and **A. Lester** (trading as Lester & Marquis), importers and merchants of electrical goods, 9, Farringdon Avenue, E.C.—These debtors again attended on March 24th at the London Bankruptcy Court for public examination upon accounts showing liabilities of £5,487 and assets of £30. They began business in February, 1924, and in September, 1927, formed Beam, Ltd., to exploit a trade-mark. The company went into compulsory liquidation last October. They were also interested indirectly in a business carried on as the Aldersgate Radio at 37, Aldersgate Street by Lester's son and in another business at Wembley carried on by Marquis's sister. They alleged that they had no financial interest in either of those concerns. Mr. Anderson, on behalf of the trustee and creditors, questioned Marquis upon various matters, and the examination of both debtors was concluded.

H. M. P. Bridge (trading as the Bellhouse Radio and Electrical Salon), 44, Bellhouse Road, Sheffield, Yorks.—The first meeting of creditors took place on March 29th at the Official Receiver's Offices, Figtree Lane, Sheffield, when a statement of affairs was submitted which disclosed unsecured liabilities of £731 and a deficiency of £431. Debtor considered that his failure was due to "too heavy overhead expenses in relation to the turnover, selling sets under cost, loss on sales under execution, and inability to collect book debts." The matter was left in the hands of the Official Receiver, as trustee.

W. S. Handley and **G. Taylor** (trading as Handley and Morgan), wireless dealers, 55, Lower Union Street, Bristol.—The first meeting of creditors was held recently at the Official Receiver's Office, 26, Baldwin Street, Bristol, when a statement of affairs was submitted which disclosed ranking liabilities of £967 and a deficiency of £879. The failure was attributed to "want of capital, heavy overhead charges, and pressure by creditors." The case was left in the hands of the Official Receiver as trustee.

E. Whitehouse, electrical and radio engineer, 29, Westfield Street, St. Helens.—Receiving order made March 20th on debtor's own petition. First meeting, March 31st, at the Official Receiver's offices, Government Buildings, Victoria Street, Liverpool. Public examination, May 9th, at the Court House, Liverpool.

D. S. B. Shannon, electrical engineer, Carlton Chambers, Lichfield Road, Mere Green.—Trustee, Mr. F. E. Bendall, 3, Warwick Passage, Corporation Street, Birmingham, appointed March 20th.

G. Howard, electrical engineer, 10, Alford Grove, Sprowston, Norfolk.—Last day for receiving proofs for dividend April 7th. Trustee, Mr. C. B. L. Prior, 4, Eastbourne Place, Prince of Wales Road, Norwich, Official Receiver.

F. W. T. Mussett (Ferensway Electrical Co.), electrician, 31, Spring Bank, Hull.—Last day for receiving proofs for dividend April 12th. Trustee, Mr. J. E. D. Stickney, 1, Parliament Street, Hull, Official Receiver.

H. A. Langlois (Electrical Installation Co.), electrical contractor, 2, Atlas Place, Cardiff.—Receiving order made March 23rd on a creditor's petition.

C. Bassham (Ashton & Holt), electrical engineer, 16, Cross Street, Ryde, Isle of Wight.—Discharge suspended for four months until July 1st, 1933.

R. O. Woodruff, electrical and radio engineer and contractor, 4, Bridge Parade, Godstone Road, Purley.—Discharge suspended for one year until February 23rd, 1934.

C. E. Wooton, electrical engineer, 10, Cemmaes Terrace, Collett Road, Hemel Hempstead.—Trustee, Mr. H. C. McMillan, 5, High Holborn, W.C., appointed March 28th.

A. C. Gardner, wireless dealer, 7, Midland Road, Derby.—Receiving order made March 20th on debtor's own petition.

Company Liquidations

Yagerphone, Ltd., radio manufacturers, Ponders End, Middlesex.—The statutory meeting of creditors was held on March 31st at the Incorporated Accountants' Hall, Victoria Embankment, S.W., when the company's solicitor, Mr. H. Fishman, said that the shareholders had previously passed a resolution nominating Mr. R. York Rickards, and Mr. C. Latham, of the Wireless and Allied Trades Guardian Association, 78, New Oxford Street, W., as joint liquidators. A statement of affairs was submitted which disclosed liabilities of £5,840, all due to unsecured creditors, and assets of £6,258, from which had to be deducted debentures and interest amounting to £2,010, leaving net assets of £4,248, or a deficiency of £1,592. A resolution was passed confirming the appointment of Mr. Rickards and Mr. Latham as joint liquidators with a committee of inspection. The following are the principal creditors: B. & J. Wireless, Ltd., £115; British Rola Co., Ltd., £198; Charles D. Clayton, Ltd., £279; Collaro, Ltd., £250; General Electric Co., Ltd., £459; Kayley, £163; Marconi's Wireless Telegraph Co., Ltd., £366; Mullard Wireless Service Co., Ltd., £104; Nuvolian Electric, Ltd., £106; Preh Manufacturing Co., Ltd., £113; A. F. Pocock & Co., £111; Singleton, Fabian & Co., £230; Telegraph Condenser Co., Ltd., £197; Williams & Moffatt, Ltd., £188; H. Yager (London), Ltd., £787.

Frank Taylor (Electrical Services), Ltd., electrical and wireless goods dealers, 109, Thornton Road, Bradford.—The creditors were called together recently at the Chamber of Commerce, Bradford, when a statement of affairs submitted showed ranking liabilities of £932, all due to unsecured creditors, and assets of £808. After allowing £57 for preferential claims, the net assets were £751, leaving a deficiency of £181 as regarded the creditors. The issued capital of the company was £300, all of which was fully paid, and as regarded the shareholders there was a deficiency of £481. The position was attributed to lack of working capital and severe competition. A resolution was passed confirming the voluntary liquidation of the company with Mr. C. D. Buckle, of 13, Cheapside, Bradford, and Mr. C. H. Baker, Standard Buildings, City Square, Leeds, as joint liquidators. A committee of the representatives of the principal creditors was also appointed. The following are the principal creditors: General Electrical Co., Ltd., £206; James Taylor & Sons, Ltd., £52; Walsall Conduits, Ltd., £85; J. B. Hallawell, Ltd., £277; T. Dyson, Ltd., £50.

Taylors (Huddersfield), Ltd., wireless dealers, &c., 9, Shambles Lane, Huddersfield.—At the meeting of the creditors held at Huddersfield recently, the statement of affairs showed ranking liabilities of £8,342 and assets totalling £2,887. After allowing £505 for preferential claims, the net assets were £2,382, leaving a deficiency as regarded the creditors of £5,960. The issued capital was £4,400, all fully paid, and the deficiency as regarded the shareholders was £10,360. The deficiency was attributed to losses on trading up to March 8th last totalling £7,039, and the depreciation written off the assets. Resolutions were passed confirming the voluntary liquidation, with Messrs. H. V. Wood and F. B. Watson as joint liquidators, with a committee of three of the creditors.

Richard Johnson & Nephew, Ltd.—Meeting May 1st at 46, Brown Street, Manchester, to receive an account of the winding up by the liquidator, Mr. H. Fielden. The winding up of the company, which was incorporated in 1900, is purely formal for the purpose of the sale of the goodwill and certain of the assets of the company to a new company, and all creditors have been, or will be, paid in full.

London Platino-Brazilian Telegraph Co., Ltd.—Meeting May 1st at 5, London Wall Buildings, Finsbury Circus, E.C., to receive an account of the winding-up by the liquidator, Mr. A. R. Smith.

Clay Cross & District Electric Supply Co., Ltd.—Meeting May 1st at Clay Cross Works, Clay Cross, to receive an account of the winding-up by the liquidator, Mr. J. Steen.

B. & J. Wireless, Ltd.—Winding-up voluntarily. Liquidator, Mr. T. Froude, 1, Queen Victoria Street, E.C.

J. & E. Matthews, Ltd.—Winding up voluntarily. Liquidator, Mr. W. F. Chaundy, 71, Temple Row, Birmingham.

William Johnson & Co. (Sheffield), Ltd.—Winding up voluntarily.

Private Arrangement

Lotus Radio, Ltd., manufacturers of wireless sets, Lotus Works, Mill Lane, Liverpool.—A meeting of creditors was held on March 28th at Frascati's Hotel, London, for the purpose of considering the following resolution: "That the creditors represented at this meeting agree to accept a composition of 12s. 6d. in the £ upon the debts due to them by Lotus Radio, Ltd." Mr. J. J. Mee, a director, who presided, said that an approximate statement of affairs had been prepared which disclosed liabilities of £87,817, and assets estimated to produce £43,810. After providing for certain preferential claims there was £36,427 available for the unsecured creditors. The chairman added that if the creditors agreed to accept the offer of 12s. 6d. in the £ a strong local body from Liverpool would be prepared to find additional money to continue the business. He also understood that the composition would be paid on or before April 15th. The resolution was carried *nem. con.* It was also decided that an informal committee which had already been formed should be asked to continue to act as an advisory committee, and that the receiver meanwhile should remain in possession.

Dissolutions of Partnership

Broughton & Irlam Electrical Engineering Co., electrical engineers, 434, Bury New Road, Higher Broughton, Manchester.—Messrs. C. Townsend, J. England, and J. Whiteley have dissolved partnership, so far as concerns Mr. Townsend, who retires from the firm. Messrs. England and Whiteley will attend to debts and carry on the business.

Master Radio Co., radio manufacturers, 102-5, Shoe Lane, E.C.4.—Messrs. L. F. Lambert, A. Kearney and H. G. Cutler have dissolved partnership. Messrs. Lambert and Kearney will attend to debts and carry on the business.

Pooley & Austin, engineers and manufacturers, 34, Broadway, Westminster, S.W.—Messrs. F. Pooley, F. C. Austin and W. L. Wreford, have dissolved partnership. Messrs. Pooley and Austin will continue the business, and Mr. Wreford will take over control of Industrial Electroplant, Ltd., hitherto a subsidiary company of Pooley & Austin.

Electricity Supply

Lighting, Domestic, Power

Bala.—NEW ELECTRICITY PROPOSALS.—A meeting of ratepayers is to be held to consider electricity schemes for the town. The use of a crude-oil engine for generating purposes is favoured by the Urban District Council, the cost of this proposal being estimated at £3,954, excluding the street lighting.

Barnard Castle.—SUPPLY TO HARMIRE.—The question of supplying electricity to Harmire is under the consideration of the Urban District Council and the North-Eastern Electric Supply Co., Ltd.

Barnstaple.—REVISION OF CHARGES.—The Town Council has adopted the following new scale of charges for electricity: Lighting, two rate systems for all consumers who contract to pay for not less than 500 kWh per quarter, 4 p.m. to 10 p.m., 7½d. per kWh; 10 p.m. to 4 p.m., 4d. Manufacturing industries (under contract for power), light used in works only, 5d. per kWh. After-hour shop window lighting, 2½d. per kWh. Power, first 200 kWh per quarter, 4d.; next 350 kWh, 3d.; next 450 kWh, 2d. Heating and cooking, 1½d. Meter rents, 2½ to 20 A, 1s. 6d. per quarter. There are to be minimum quarterly charges of 7s. 6d. in the winter and 5s. in the summer.

Barrow-in-Furness.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to Bardsea at an estimated cost of £811.

Birkenhead.—EXTENSION PROPOSAL.—The Town Council will hold a special meeting on May 2nd to consider, among special resolutions connected with electricity in Wirral, one providing for application to be made to the Electricity Commissioners to extend the Council's area of supply so as to include the urban districts of Wirral and Neston, parts of the urban districts of Bebington and Ellesmere Port, and part of the rural district of Chester.

Bowes (Co. Durham).—INQUIRIES REGARDING A SUPPLY.—The Parish Council has decided to communicate with the North-Eastern Electric Supply Co., Ltd, asking it for its promised estimate of the cost of bringing electricity to the village and the time likely to be taken in carrying out the work.

Cheltenham.—SAVINGS ON CHANGE-OVER.—The cost of the change-over which has just been completed was £6,128 under the original estimate of £33,884, the cost of the new ring main amounting to £51,262.

EXTENSIONS.—The completion of the three-phase link between Evesham House sub-station and Noverton Lane sub-station is to be carried out at an estimated cost of £1,519, and the overhead line supplying Bishop's Cleeve is to be continued from the Woodmancote sub-station to the Bishop's Cleeve sub-station at a cost of £311.

SALARY ARBITRATION RESULT.—Sir Harold Morris has recently held an arbitration into the claims of the employés who have either been displaced or have suffered reductions in salaries, and has submitted an award setting out the compensation to be paid to each claimant. The total amount payable is £3,101 10s., plus £7 15s. costs and arbitration fee.

Colne.—LOANS.—Sanction has been received by the Corporation to the borrowing of £1,347 for mains in connection with the change-over from d.c. to a.c., and the extension of electricity supply to the south side. Existing borrowing powers being exhausted, application is to be made for the borrowing of £7,500 to meet prospective expenditure for two years.

Coventry.—FRINGE ORDER.—The City Council has given sanction to a Fringe Order to enable the Leicestershire & Warwickshire Electric Power Co. to supply electricity to premises at Wall Hill Lane, Allesley, which is within the Corporation's area of supply.

Egypt.—ANOTHER ASSOUAN POWER SCHEME.—According to an *Exchange Telegraph* message, the Egyptian Ministry of Public Works is drafting another and less expensive scheme for generating electricity from the Assouan dam, and tenders are to be invited in the next financial year. The old scheme for which tenders had been invited has been cancelled.

Finchley.—EXTENSIONS.—The Electricity Committee is to extend the rectifier equipment in the Hill Rise sub-station and install a balancer set in the Hamilton Road sub-station, &c., at a cost of £2,040.

France.—DECREASED GENERATION IN 1932.—According to the *Revue Générale d'Electricité*, the output of the fifty principal power stations in France (representing about 64 per cent. of the total French production) amounted last year to 8,902,951,954 kWh as compared with 9,385,964,458 kWh in 1931, a decrease of 5.14 per cent. Of the total, hydro-electric plants were responsible for 4,962,555,785 kWh and steam and internal-combustion-engine stations for 3,940,496,169 kWh. Our contemporary says that the aggregate production of electricity in France during the past twelve months may be taken as 13,800 million kWh, as against 14,395 million kWh in 1931.

Glasgow.—PROGRESS IN FEBRUARY.—Under the Electricity Department's scheme 164 houses were wired in February, making a total of 37,176. Hired appliances now number 18,840.

MAINS EXTENSIONS.—Distributing mains are to be laid at an estimated cost of £6,120.

Glyncorrwg.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the South Wales Electric Power Co. to supply the urban district.

Guildford.—SUPPLY AREA BOUNDARIES.—Meetings have been held between the Electricity Committee and representatives of the Mid-Southern Utility Co. to discuss the question of the unsatisfactory boundary of the supply area at Compton Village. It is suggested that the engineers should determine a satisfactory electricity area, and that the company should supply this area until part or the whole of Compton is added to the municipal borough, after which the Corporation may resume the supply in the predetermined area, even although this is partly beyond the Corporation's present limits in Compton. The Committee has agreed to a request from the company to be allowed to proceed with the laying of mains partly within the Corporation's supply area in order to serve a number of its own consumers, subject to the company's acquiring no distribution rights within the Corporation's area of supply until the above-mentioned question is settled.

NEW MAINS.—Mains extensions are to be carried out on the Paddocks Estate, Burpham, at a cost of £210, and at the new building estate at Pareora, Epsom Road (£130).

PUBLIC LIGHTING.—The Electricity Committee is applying for sanction to the borrowing of £2,000 for public lamps.

Hull.—REVISION OF ASSISTED WIRING SCHEME.—The Electricity Committee has agreed to extend the provisions of the assisted wiring scheme, and to withdraw the present limitation of ten points, allowing the existing specification and prices to apply to any number of lighting points required by the consumer.

The Electric Lamp Manufacturers' Association has an exceedingly neat stand at the Ideal Home Exhibition

Iceland.—NEW HYDRO-ELECTRIC STATION.—A Swedish-Icelandic company has started the construction of a hydro-electric station in the south-west of the island, and has submitted an offer to supply the town of Reykjavik. The cost of the undertaking is estimated to be about £112,000.

Irlam.—STREET LIGHTING IMPROVEMENTS.—Permission has been obtained by the Urban District Council to the borrowing of £3,000 for the substitution of electric lighting for gas in Liverpool Road, and it has been decided to invite tenders for the lighting standards. Next winter the whole length of Liverpool Road through the district will be electrically lighted.

Japan.—TOKYO COUNCIL'S SUPPLY SCHEME.—In connection with the Tokyo Council's scheme to build a large water reservoir at Kogochi on the Tama River at a cost of 40,000,000 yen, the Municipal Electricity Committee has approved a proposal for the generation of the necessary power by the Council itself at a cost of 29,000,000 yen. The project provides for the purchase of the undertaking of the Tamagawa Hydro-Electric Power Co., Ltd., and the erection of a power station at Shibaura. It is stated that the plant capacity will be 71,750 kW.

NEW POWER STATIONS.—The erection of new power stations is under consideration by the following: The Oi-gawa Power Co. (63,000 kW at a cost of 12,000,000 yen), the Toho Power Co. (40,000 kW, 4,620,000 yen), the Imperial Rayon Manufacturing Co. (20,000 kW), and the Korean Nitrogenous Manure Co. The Japan Electric Power Co. also proposes to extend the capacity of its Tokyo power station by 10,000 kW.

Korea.—HYDRO-ELECTRIC DEVELOPMENT.—The *Far Eastern Review* reports that thirty-five applications have been received by the Korean Government for permission to establish hydro-electric undertakings in Korea. The most important are those of the Korean Electric Industrial Co. (capital £3,000,000), the Korean Electric Power Co. (£5,000,000), the Korean Nitrogenous Manure Co. (£5,000,000), the Seoul Electric Co.

(£1,900,000), the Korean Railway Co. (£1,720,000), and the Korean Central Hydro-electric Co. (£1,000,000).

Lancaster.—Assisted Wiring.—The Corporation has adopted a scheme for the wiring of houses and the supply of fittings on a deferred-payment system spread over a period of three years.

Extensions.—Electrical extensions to be carried out with the object of making electricity available in any part of the town will cost £20,000 (mains £15,000, services £5,000).

Liverpool.—Change-over Programme.—In his budget statement to a recent meeting of the City Council, Sir Max Muspratt mentioned that the Electricity Department had embarked on a long-term programme for the conversion of supply system from d.c. to a.c. When this was carried out, an expenditure of £200,000 from capital account would have been incurred and work found for 400 men.

London.—The L.J.E.A. Draft Order Inquiry.—The public inquiry into the application of the London and Home Counties Electricity Authority which was adjourned on February 10th will be resumed by the Electricity Commissioners at the Institution of Electrical Engineers, London, on April 10th.

Cheaper Electricity.—Reductions in electricity charges involving a concession of £50,000 to consumers are announced by the " Metesco " group of companies operating in the London and Home Counties districts.

Maidenhead.—Extensions.—The Town Council is to provide electricity in the Fifield, Forest Green, Sturt Green, and Touchen End districts.

Maidstone.—Extensions.—The Electricity Committee recommends mains extensions to supply Glebe Lane, Barming (£260), the Preston Hall bungalows (£485), and Dean Street, East Farleigh (£1,950).

Manchester.—New Feeder.—The Electricity Committee is to lay a feeder main from Barton to West Didsbury at a cost of £66,500.

Morecambe.—Electricity for Housing Estate.—At the request of Messrs. Brook & Kershaw, a supply of electricity is to be given to the housing estate to be built off Westgate.

Newbury.—Change-over.—The Urban Electric Supply Co., Ltd., is to remove a rectifier from Oxford Road to the centre of the town, and to change over to a.c. the whole of the area between the Bath and Oxford Roads from the junction of these roads.

Oakham.—Protest Against Proposed Charges.—With reference to the proposed supply of electricity in the rural area by the Oakham Gas & Electricity Co., Ltd., the Rural District Council has protested against the proposed tariff and the imposition of minimum charges, and expresses the opinion that the charges should not be higher than those fixed by the Mid-Lincolnshire Electric Supply Co., Ltd., in other portions of the rural area.

Oxford.—Electric Cooking for a Hospital.—The Electricity Committee is to make an offer to the Hospital and Infectious Diseases Sub-Committee to equip the kitchen at the hospital with cooking apparatus.

Port Talbot.—Street Lighting Inquiry.—The Ministry of Health has notified the Corporation that it intends shortly to hold an inquiry into the Council's application to convert the whole of its street lighting from gas to electricity.

Rainford.—Electricity for Mosborough.—The Urban District Council has decided to press the Ministry of Transport to sanction the extension of mains from St. Helens to Mosborough. Mr. W. S. Johnston, borough electrical engineer of St. Helens, has informed the Council that as soon as sanction is received every effort will be made to proceed with the extension.

Russia.—New Power Station at Tagil.—The building has been commenced of a large power station at Tagil in the Urals intended to supply power, as well as steam and air, to a big car works now being built in that city. The station, which is estimated to cost 40 million roubles, is to be equipped with two 25,000-kW turbines and five large motors and compressors, and will be finished by next year.

Salford.—Switchgear and Transformers.—The Electricity Committee is to apply for sanction to a loan of £7,500 for switchgear and transformers required in connection with an additional 6.600-V feeder cable to be laid between Agecroft power station and Moor Lane sub-station.

Scunthorpe and Frodingham.—Underground Mains.—The Urban District Council has applied to the Electricity Commissioners for permission to use £3,753 from the reserve fund for the purpose of substituting underground for overhead lines along Oswald Road and Frodingham Road.

Southport.—Relief of Rates.—The Electricity Committee is to contribute £4,150 towards the relief of rates.

Tenterden.—Electricity for Rolvenden Layne.—The Weald Electricity Supply Co., Ltd., is shortly to commence work upon the scheme for providing electricity to Rolvenden Layne.

Thetford.—Overhead Lines.—The East Anglian Electric Supply Co., Ltd., is to apply to the Ministry of Transport for consent to the use of overhead lines for the supply of electricity to the borough, and the Corporation has decided to lodge an objection unless the company is prepared to lay underground mains in all the streets in the town.

West Ham.—Loans.—The Town Council is applying for sanction to loans of £100,000 for mains and services, £15,000 for sub-stations and equipment, and £12,287 balance of £75,487 required for new offices in Romford Road, Stratford.

Westmeon.—Supply Soon.—The Mid-Southern Utility Co., Ltd., has informed the Parish Council that it is hoped to give a supply of electrictiy to Westmeon shortly, and that a canvass of the parish and other places towards Alresford is to be carried out during the next few weeks.

Wick.—Inquiry into Administration.—Mr. H. Nimmo, chief engineering inspector to the Electricity Commissioners, has been appointed to hold an inquiry into the administration of the Electricity Department. The inquiry is a sequel to allegations against the department, which led the Town Council to ask the Commissioners to have the whole matter investigated.

Wolverhampton.—The Hundred Million Mark Reached.—Over one hundred million kWh of electricity was distributed by the Electricity Department during the past year.

Traction

Austria.—Main-Line Electrification.—The installation of 15,000-V single-phase a.c. overhead equipment is now being carried out on the Salzburg-Linz section of the Vienna-Salzburg main line, and the groundwork on the Linz-Vienna section is completed. All the preliminary work for the electrification of the Vienna-Graz main line has also been completed, and on these two lines, totalling 300 miles, electric operation will commence in 1934. At the present time 525 miles, or 14.5 per cent., of the Austrian Federal Railways are electrified, nearly all of this being main line.

Bury.—Tramway Abandonment.—The Town Council has practically decided on the substitution of buses for trams, and application is being made to the Ministry of Transport for permission to abandon the tram services on six routes, including that from Bury to Breightmet. It is proposed to abandon certain of the tram routes immediately.

Dover.—Trolley-Bus Proposal.—The Town Council has decided to take steps to substitute trolley-buses for the trams at a cost of £65,000.

Glasgow.—Buses Replace Trams.—Buses have now been substituted for trams on the Paisley Cross-Abbotsinch route.

Holland.—Railway Electrification.—According to the *Railway Gazette* work has now started on the electrification of the line between Rotterdam and Dordrecht. An agreement has been made with the municipality of Rotterdam for the supply of energy to the whole section in the form of three-phase a.c. at 25,000 V, and this will be transformed and converted to 1,500 V d.c. by mercury-arc sub-stations at Feijenoord, Zwijndrecht and Schiedam. The last is not actually on the section concerned, but its construction is considered necessary in order to give a better load factor at the present Schiebroek sub-station and enable it to supply current at the Rotterdam end of the line under more favourable conditions. An intermediate switchboard station is to be built at Barendrecht, between Feijenoord and Zwijndrecht, owing to the long distance between these places. It is intended that the electric service shall begin in May, 1934.

India.—Success of Electrification in Madras.—The report of the South Indian Railway Co. states that the results of the Madras suburban electrification, for which two additional lines of tracks have been laid, are distinctly encouraging. The number of passengers now averages 125,000 per week, whereas under steam traction with single-line working, the maximum recorded for one week was only 33,000, while the operating costs show a considerable saving.

London.—Doubling of Track.—The London County Council is to double the tram track in the widened part of Streatham High Road at a cost of £3,000 by direct labour.

Manchester.—Relaying of Track.—The Corporation is to provide new junction curves for the tramway system at a cost of £1,600.

Margate.—Traffic Control.—The Town Council has received the approval of the Ministry of Transport for the installation of automatic traffic signals at three crossings.

Russia.—Electrification Schemes.—In 1931 it was decreed by the Government of the U.S.S.R. that the ultimate end of reconstruction was to be the electrification of the railways, rationalisation, and the building of power stations. The first step towards the realisation of the electrification programme was the conversion of the Transcaucasian Railways, where, says *Modern Transport*, 63 km. of line between Stalinissi and Zestaphoni has already been put into operation. Certain of the suburban railways radiating from Moscow have also been electrified. For instance, during March a 29-km. stretch of electrified double-track, extending from Kurski Station, Moscow, in the direction of Nizhni-Novgorod to Obiralovka, was opened for regular passenger traffic. In the second Five-Year Plan it is intended to extend the electrified line as far as Gorki (Nizhni-Novgorod) and to electrify the double-track railway to Kharkov as far as Kursk. Preliminary work has also been commenced for the electrification of the first section of the Kharkov line between Moscow and Podolsk, a distance of 45 km.

Communications

Australia.—RADIO LICENCES.—Between December, 1931, and January, 1933, the number of broadcast radio receiving licences in use increased by 90,163 to a total of 427,821. There were 3,750 cancellations and 12,391 new issues. New South Wales increased by 3,167 to 163,139. Victoria's growth was 266 to 159,975, Queensland's 854 to 33,037, South Australia's 1,232 to 41,594, Western Australia's 512 to 16,639, and Tasmania's 208 to 11,437.

China.—DIRECT WIRELESS SERVICE.—Negotiations have been concluded for a direct wireless service between London and Shanghai, which, it is hoped, will be in operation towards the end of this summer. The Shanghai installation, which is being supplied by Great Britain, will be financed from the proceeds of the Boxer Indemnity Fund, and it is believed that the first portion of the machinery is already on its way to China.—*Reuter.*

Great Britain.—RADIO RELAY EXCHANGES.—The Ripon Corporation Highways Committee is to allow Mr. C. R. Pinchbeck to install a radio relay service in the city, subject to annual payments, including one shilling in respect of each wire crossing any highway over which the City Council has control, and to a proviso that no monopoly right of any kind or description be conferred.

The Morecambe Corporation has been asked to consent to the transfer of all the rights of K.L.M. Radio Relays, Ltd., to a proposed new company with a larger capital.

Hull.—TELEPHONY.—In the Corporation Telephones Committee's area there are 340 single-coin post-payment money boxes in use, of which fifty-eight are fitted in kiosks and the remainder rented by subscribers. For subscribers to the existing coin box service who desire to rent multi-coin boxes, the Post Office charge of 30s. per annum is recommended.

Middlesbrough.—MUNICIPAL WIRELESS STATION.—Middlesbrough Corporation is seeking powers to establish a relay service in its area—the first municipal station in the country. This power is sought in the Middlesbrough Corporation Bill, which was read a second time in the House of Lords on March 30th, but on the motion of Lord Mount Temple the House directed the Committee to which the Bill is to be referred to give this matter special consideration. Lord Mount Temple indicated that the proposal was to give subscribers a wireless programme by apparatus installed by the Corporation at a cost of not more than 1s. 6d. per week. He argued that to give this power to a municipality was not in the public interest. Lord Darvngton stated, for the promoters of the Bill, that the B.B.C. and the Postmaster-General agreed to the Corporation's proposal, with one or two minor amendments.

Philippine Islands.—RADIO-TELEPHONY.—Telephone communication has been opened between Madrid and Manila, in the Philippine Islands, a distance of 7,000 miles.

Romford.—WIRELESS FOR NEW AIR SERVICES.—All the aircraft for the new air services operated by Hillman's Airways from their aerodrome at Romford are to be fitted with Marconi equipment. No tuning will be necessary, as the service will be operated on a fixed wavelength. To call up ground stations, the pilot has only to turn a switch on the control board in the cockpit and speak into a small microphone. For reception, he turns the switch over to the "receive" position and listens in the headphones. The Marconi Company is fitting six Hillman aircraft with type A.D.6N apparatus, which is compact and light. Every expedient has been adopted to reduce the size and weight of the apparatus to the minimum.

Tottenham.—MAINS RADIO.—The U.D.C. Housing Committee has agreed with the North Metropolitan Electric Power Supply Co. that, as rapidly increasing numbers of tenants are anxious to make use of mains-operated wireless sets, the company shall allow the extension of the use of electricity for this purpose for an additional fixed sum of 1d. per week in each case, which is to be collected by the Council with the usual fixed charge, deducting 5 per cent. to cover cost of collection.

Washford Cross.—NEW B.B.C. STATION.—*The Times* reports that Mr. E. R. Appleton, Regional Director, B.B.C., addressing the Cardiff Rotary Club on April 3rd, said that the new West Regional transmitter of the B.B.C. at Washford Cross, Somerset, would be opened in the summer. Public reception tests would begin on April 24th, but the date of the actual transmissions would depend to some extent on listeners' reports. He explained that the new transmitter would be of a modern twin-wave type with a power of 50 kW, compared with the present power of 1½ kW. The regional programme would be given on the present wavelength of 309.9 metres and the national on 261.6 metres. The studios at Cardiff were being redesigned and reconstructed and additional studios were being built at Bristol.

World Telephony.—A SURVEY.—Telephones in use in all countries have increased by 70 per cent. in the last ten years to a total of 101,401,419, which is 14,485,917 more than there were in 1921, representing 1.8 per 100 inhabitants of the world. Since 1930 the number of instruments in use in the U.S.A. and Canada has decreased by 6 per cent., but Europe has installed 100 per cent. more during the last ten years, and now has from 1.2 to 2 telephones for every 100 persons. Asia has increased its telephones by 153 per cent. since 1921; of the 755,895 added in ten years, Japan claims 582,560. Africa shows the least development in extension, for only 247,000 new stations were installed in ten years. In that time Australia has added 520,169 and New Zealand 164,739. Denmark makes most telephone calls per head of the population, and Sweden is second. San Francisco is still the city with the most telephones; it has 40.2 per 100 inhabitants. Stockholm is next with 30, Helsingfors has 14, Paris 13, and Berlin 12; London has only 9.6, and Tokyo 4.—*Reuter* (Helsingfors).

Cheadle Street Lighting

IN view of the constantly increasing traffic, the introduction of a fast bus service and also to bring the system of lighting into conformity with the practice already adopted by the authorities in adjoining towns, the Cheadle and Gatley Urban District Council decided last summer to improve the street lighting on the main roads, and permission was received from the Ministry of Health to spend about £2,000 for that purpose.

The first portion of the scheme was the re-lighting of the main road from Altrincham to Stockport, approximately 3,066 yd. Various methods of lighting were considered, and the installation was so planned that lamps of higher power could be installed at a later date, if necessary. New steel pillars were erected on alternate sides of the road at 40-yd. intervals, the height of the lamp filament from the ground being 21 ft. The whole of the lighting is controlled automatically by means of time switches, the lamps being switched on in groups of ten or twelve.

The bracket and lantern unit used has been designed and manufactured by the Wardle Engineering Co., Ltd., and comprises a 22-ft. steel pole with cast iron base and door (spigot diameter 4 in.), an ornamental wrought iron bracket, and a "No 5194" Wardle "Polygon" lantern.

The lantern was specially designed for the installation and comprises a cast iron dome with a ring riveted to the body and hinged from the dome. It has a spun copper body and internal reflector, with fixed porcelain lampholder. A one-piece dioptric dome refractor is secured to the internal reflector by three spring hooks, while the clear glass outer globe may readily be removed. Focusing of the lamp is carried out by a knurled head and screw. Access to the focusing head is obtained by opening the lantern at the upper hinged ring, thus preventing unauthorised interference.

Upon completion of this scheme, which is being carried out by the Electricity Department under the supervision of Mr. R. W. Willis, electrical engineer and manager, the street lighting of the town will consist of more than 800 standards and electrical units. There will still remain about fifty gas standards and these will be converted to electricity as soon as circumstances permit, thus adding another name to the rapidly growing list of towns with all-electric street lighting.

An example of the new street lighting at Cheadle, with (inset) the Wardle fitting employed

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Ashford.—April 21st. Electricity Department. Two 6,600-V truck-type cubicles. (See this issue.)

Australia.—MELBOURNE.—June 7th. City Council. One or two boiler units. (G. 12425.)*
May 23rd. Posts and Telegraphs Department. Protective apparatus. G.P.O., Melbourne.
BRISBANE.—June 22nd. City Electric Light Co., Ltd. 45-kV and 11-kV switchgear. (A.X. 11749.)*
July 20th. Supervisory control equipment for circuit breakers. (A.X. 11750.)*
SYDNEY.—June 14th. N.S.W. Department of Railways. 500-kW turbo-alternator for Zarra Street power station. (A.X. 11762.)*

Cheadle and Gatley.—April 13th. Electricity Department. L.p. switchgear. (March 31st.)

Deptford.—May 3rd. Town Council. Lamps. (March 31st.)

Dover.—April 21st. Corporation. Switchgear, transformers and rotary convertor. (March 31st.)

Dumfries.—April 29th. County Council. House service meters. (See this issue.)

Egypt.—CAIRO.—April 25th. Ministry of the Interior. Motors, control panels, meters, &c. (A.X. 11738.*)

Glasgow.—April 24th. Electricity Department. Cables, flexibles, meters, and cable covering tiles. (See this issue.)

India.—NEW DELHI.—April 24th. Indian Stores Department. Wall plugs, ceiling roses, &c. (A.X. 11739.)*

Liverpool.—April 26th. Corporation. Cables, compounds, and tapes for street mains. (See this issue.)
April 24th. Generating plant. (See this issue.)

London.—LONDON AND HOME COUNTIES JOINT ELECTRICITY AUTHORITY.—April 26th. Meters, transformers, and cables. (See this issue.)
FULHAM.—April 12th. Borough Council. Prepayment and quarterly house service meters. (March 31st.)

Manchester.—April 19th. Electricity Department. Kettles, current transformers, meters, cables, industrial electric motors, and time switches. (See this issue.)

Morocco.—CASABLANCA.—April 19th. Public Works Department. Electric cable and transformer sub-stations for supplying four coal-handling cranes. (A.X. 11733.)*

New Zealand.—WELLINGTON.—May 23rd. Public Works Department. Three 110-kV oil-immersed circuit breakers. (A.X. 11751.)*

Salford.—May 1st. Electricity Department. Transformer and metal-clad switchgear panels. (See this issue.)

South Africa.—JOHANNESBURG.—May 5th. Government Supplies Board. 2¼ miles of telephone cable and 1,280 miles of insulated wire. (A.X. 11761.)*

Southport.—April 11th. Southport and District Water Board. Three electrically driven centrifugal pumping sets. Mr. C. B. Ede, engineer and manager, 14, Portland Street (deposit £3 3s.).

Tilbury.—April 10th. Urban District Council. Electric lighting and cooking installations in Council houses. (March 24th.)

West Riding.—County Council. Persons and firms wishing to have their names placed on the list of those from whom the Supplies Committee may invite quotations for various services and stores are asked to apply to the manager, Supplies Department, Cliff Lane, Wakefield. (March 24th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barrow-in-Furness.—Markets Committee. Accepted. Electric stunning apparatus in pig slaughter hall.—Industrial Waste Eliminators, Ltd.
Electricity Committee. Accepted. Mechanical stoker for boiler house (£3,000).—Underfeed Stoker Co., Ltd.

Bath.—Watch Committee. Accepted. Traffic Signals (£310).—Automatic Electric Co., Ltd.

Cheltenham.—Electricity Committee. Accepted. Cables for supply to Shurdington.—Hackbridge Cable Co., Ltd.

Chesterfield.—Electricity Committee. Accepted. E.h.p. truck cubicle (£194).—British Thomson-Houston Co., Ltd. E.h.p. and pilot cable (£1,156).—Derby Cable Co., Ltd. Transformer kiosk (£340).—Yorkshire Switchgear & Engineering Co.

Durham.—County Education Committee. Accepted. Installation of electric lighting at the Dubmire and Hetton-le-Hole Council Schools.—B. L. Oliver. Installation of electric lighting at the Newbottle Council School.—F. Reid, Ferens & Co.

Glasgow.—Corporation Electricity Committee. Accepted. Plant required in connection with the change of frequency: Thirty transformers reconditioned (£11,220).—British Electric Transformer Co., Ltd. Nine transformers reconditioned (£3,888).—Metropolitan Vickers Electrical Co., Ltd. Eighteen transformers reconditioned (£6,012).—Ferranti, Ltd.
Transport Committee. Accepted. Six transformer cores.—General Electric Co., Ltd. Magnet coils in cases.—Metropolitan-Vickers Electrical Co., Ltd.
Cleansing Committee. Accepted. Two batteries for replacement of worn-out batteries (£315).—Tudor Accumulator Co., Ltd.
Education Committee. Recommended. Goods lift (£323).—Glasgow Engineers, Ltd. Passenger elevator at new Trades School (£426).—A. & P. Steven, Ltd.

Guildford.—Housing Committee. Accepted. Wiring 156 houses at Stoke Hill Estate (£83).—Hall & Stinson, Ltd.
Sewerage Committee. Accepted. Electric wiring at sewage works (£84).—A. Grove.

Hull.—Telephones Committee. Recommended. Insulators (£85).—Bullers, Ltd. Inside wire (£75).—Henleys, Ltd. Telephones (£700).—Automatic Electric Co., Ltd.

Leeds.—Electricity Committee. Accepted. Three three-panel cubicle equipments (£341).—Crompton Parkinson, Ltd. Two four-panel cubicle equipments (£392).—Electric Construction Co., Ltd. One four-panel cubicle equipment (£242).—Switchgear & Cowans, Ltd. Meters for twelve months (minimum quantity 3,000) at scheduled prices.—Measurement, Ltd. 200-kVA 6,600-V single-phase transformers, three-phase transformers and three-phase Scott transformers required during the ensuing two years.—Electric Construction Co., Ltd.

Plymouth.—Electricity Committee. Accepted. Cables.—British Insulated Cables, Ltd. Meters.—Chamberlain & Hookham, Ltd.; Metropolitan-Vickers Electrical Co., Ltd. E.h.p. switchgear.—General Electric Co., Ltd.; A. Reyrolle & Co., Ltd. L.p. switchgear.—A. Reyrolle & Co., Ltd. Transformers and time switches.—General Electric Co., Ltd. Reblading generating set (£628).—Metropolitan-Vickers Electrical Co., Ltd.

Salford.—Watch Committee. Recommended. Vehicle-operated traffic signals at Broughton (£427).—Automatic Electric Co., Ltd.
Electricity Committee. Recommended. Three soot blowers (£139).—Babcock & Wilcox, Ltd. Switchgear for Pump Street sub-station (£490), and Blackfriars sub-station (£108), and protective gear (£111).—Metropolitan-Vickers Electrical Co., Ltd. Fuse board (£156).—English Electric Co., Ltd.

Sheffield.—Corporation Electric Supply Committee. Accepted. Transformers.—Hackbridge Electric Construction Co., Ltd. (£953); English Electric Co., Ltd. (£953); General Electric Co., Ltd. (£238); Ferranti, Ltd. (£296).
Tramways and Transport Committee. Accepted. Tramcar trucks (thirty at £152 each).—Brush Electrical Engineering Co., Ltd.
Health Committee. Recommended. Wireless installation at Crimicar Lane hospital (£192).—J. Riley & Sons.

Forthcoming Events

Electrical Association for Women.—Friday, April 7th. Dorchester Hotel, Park Lane, W. 9 p.m. Annual ball.

Institute of Transport.—Monday, April 10th. Institution of Electrical Engineers, London. 5.30 p.m. Joint meeting with I.E.E. "Electric Trolley Omnibuses." Mr. C. J. Spencer.

Illuminating Engineering Society.—Tuesday, April 11th. Institution of Mechanical Engineers, London. 7 p.m. Discussion on "Hospital Lighting." Opened by Mr. F. C. Raphael.

Association of Supervising Electrical Engineers.—Tuesday, April 11th. Junior Institution of Engineers, London. 7.15 p.m. "Industrial Electric Heating." Mr. V. O. Cutts.

Institution of Electrical Engineers.—(*Meter and Instrument Section*).—Friday, April 7th. Institution, London. 7 p.m. "Electrical Methods of Geophysical Prospecting." Mr. J. McG. Bruckshaw. (*North-Eastern Students' Section*).—Friday, April 7th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Annual general meeting and short paper night. Saturday, April 8th. 3 p.m. Visit to Dunston power station. (*Mersey and North Wales (Liverpool) Centre*).—Monday, April 10th. The University, Liverpool. 7 p.m. Annual general meeting. (*Western Centre*).—Monday, April 10th. Town Hall, Cheltenham. 6 p.m. "An Analysis of the Costs of Electricity Supply and Distribution, &c." Mr. Kennedy and Miss Noakes. (*North-Eastern Centre*).—Monday, April 10th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "The Steel-Melting Coreless Induction Furnace." Mr. M. J. Marchbanks. (*Tees-side Sub-Centre*).—Monday, April 10th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. Annual meeting. Film on "The Electrification of an Up-to-date Colliery." (*Scottish Centre*).—Tuesday, April 11th. Institution of Engineers and Shipbuilders in Scotland, Glasgow. 7.30 p.m. Paper by Mr. J. M. Kennedy and Miss D. M. Noakes. (*London Students' Section*).—Tuesday, April 11th. Institution, London. 6.15 p.m. "The Moledrainer Method of Laying Cables." Mr. R. N. Hamilton. (*North Midland Students' Section*).—Tuesday, April 11th. Hotel Metropole, Leeds. 7.15 p.m. Annual meeting. (*North-Western Students' Section*).—Tuesday, April 11th. Engineers' Club, Manchester. 7.15 p.m. Annual meeting. Informal discussion on "The Future of the Engineer." Opened by Messrs. W. Jackson and G. W. Polgreen. (*Hampshire Sub-Centre*).—Wednesday, April 12th. University College, Southampton. 7.30 p.m. "Metal-Clad Switchgear, Automatic Protection, and Remote Control, with particular reference to developments during the last seven years." Mr. H. W. Clothier.

X-Rays in Mineralogy

The effective use of ultra-violet rays for examining minerals is due to the varying colour and intensity of fluorescence produced when the rays fall on certain substances. The reason, according to *Sand, Clays and Minerals*, is probably connected with the transfer of minute quantities of energy from one part to another of the substance concerned. A New Jersey firm extracting zinc is using the method for routine tests for willermite in the tailings from the crushed ore. Real and synthetic precious stones can be distinguished, and effective illumination of show cases in geological museums has been carried out by ultra-violet light.

Notes

Traffic Control in Trafalgar Square

The Mayor of Westminster, Councillor the Rev. E. St. G. Schomberg, inaugurated on Monday the automatic street traffic signal system which has been installed in Trafalgar Square by the City of Westminster. The "Electro-matic" system (Automatic Electric Co., Ltd.) has been adopted, which is operated by the vehicles themselves passing over "detectors" laid in the roadways. It employs red, amber, and green lights, as standardised by the Ministry of Transport.

At Trafalgar Square the traffic flows from so many directions and in such varying densities that a special scheme has been evolved in collaboration with the officials of the City of Westminster, the Ministry of Transport, and the Metropolitan Police, who estimate that more than 65,000 vehicles pass through the controlled area daily, and that the travelling public will be saved £2,700 per day by the reduction of waiting time.

As the vehicles arrive and indicate their presence to the control mechanism by passing over the detectors laid in the roadways, the signal periods are automatically adjusted to meet the prevailing conditions, and the "right-of-way" is apportioned to enable traffic to flow freely, and with safety, for periods which constantly vary in a definite relationship to the volume of traffic. Altogether, there are twenty-three sets of signals in Trafalgar Square and eighteen detectors laid in the approach roads at distances varying from 90 to 110 ft. back from the intersection. The signals at Duncannon Street, with the exception of the centre one, are fitted with an additional face indicating left and right turn for "filtration."

Very shortly a further application of the "Electro-matic" principles will be inaugurated in Piccadilly. For the control of traffic in such extremely congested thoroughfares each intersection operates as a straightforward installation until traffic increases to predetermined traffic densities. Then a master controller automatically takes charge and introduces the "flexible progressive" plan. Traffic then flows at a prearranged speed, which continues while the conditions hold, but the instant they change the system automatically reverts to isolated working, on the principle of "first come first served." Illustrations of the Trafalgar Square installation appear on page 489.

Electrical Toys in France

The French Union des Syndicats d'Electricité has recently been considering the question of what are to be regarded as electrical toys. A special committee has recommended that electrical apparatus intended for the use of children which has a capacity of more than 50 watts shall not be regarded as a toy, but as ordinary electrical apparatus, and consequently must be treated as such by users. Furthermore, it is recommended that electrical toys must not operate at more than 24 V between the terminals and that the device used to reduce the voltage of the electrical circuit from which power is drawn must not embody metallic connection between the main circuit and the toy, the use of series resistances and auto-transformers being thus prohibited.

A Research Handbook

A handbook of extra-university research in pure and applied science is to be compiled in which it is proposed to give data concerning commercial, endowed, and private research laboratories not included in the Universities' Year Book. It is not intended to include laboratories and other institutions devoted solely to testing materials and products, collecting data and other work not of a developmental and original character. The handbook will cover such matters as the type or types of research in progress (such as fundamental, new inventions, improvement in production methods and products), staff with qualifications, and recent publications, including patents, data of approximate floor space, and annual expenditure. Communications should be addressed to Prof. B. W. Holman, Association of Scientific Workers, 70, Victoria Street, S.W.1.

An Experimental Room for Heating Research

An insistent desire for increased facilities for the study of the heating of buildings has led to the decision to build an experimental room at the Building Research Station, Watford. This will answer not only the demand for specific investigations, but also that for increased general research. Other controlled rooms have previously been in operation where the regulation of the air temperature throughout the enveloping space has been attempted. It has been found difficult, however, even with an elaborate system of controls, to provide clearly defined conditions in the enclosure, since there is variation in the temperatures of the enclosing walls, to which the walls of the test room radiate and from which they receive radiation. In the proposed new experimental room the enclosure will be controlled by means of panel-warming and panel-cooling pipes in the walls, floor and ceiling, and the temperature of the air in the enclosure will also be regulated. It will therefore be possible to produce in the enclosure any defined weather conditions for a specified time and to repeat these conditions as frequently as may be required to procure the necessary statistics. By manipulating the warm and cold radiations, adjusting wind velocity, direction, temperature, and humidity, conditions approximating natural weather changes will be reproduced and the advantage of observing the behaviour of various methods of warming and ventilating plant when subject to the effect of such changes on the interior of the room will be manifest. The room inside the enclosure will measure 18 ft. by 12 ft., and the height will be adjustable between 8 ft. and 11 ft.

An American Oil-filled Cable

The Philadelphia Electric Company is testing a new cable installation designed by Mr. C. E. Bennett, research engineer of the Okonite-Callender Cable Company. The cable is placed in a steel pipe and then oil is forced in and maintained at a pressure of about 200 lb. per sq. in. by compressor equipment. Mr. Bennett has stated that it is probable that a typical installation would cost but 60 per cent. of a new duct line, and that it appears to open a field of service adapted to the introduction of high voltage energy into areas in large cities where overhead transmission would be out of the question. Before drawing the insulated cables into the piping, moisture is removed from the latter by blowing air through it, and in some cases the acetylene torch is employed along with compressed air. Pipe diameters up to 8 in. are being used, the greater radiation of the larger sizes being advantageous. The oil is usually warmed before being forced into the pipes. Manifolds have been designed for branches, and low points are tapped for drainage. The piping has been made up in 40-ft. lengths. Two priming coats are applied before laying in earth trenches. In the Philadelphia installation, which has been in successful service since October 15th, 1932, 66,000-V, 1,000,000 circ. mil. cable is installed in a loop carrying 104,000 kVA. The results to date indicate the possibility of later applying this scheme to three-phase cable installed in a single pipe. Very little evidence of phase unbalancing has been noted in the experimental applications.

A Trolley and Contact Wire Specification

In revising B.S. Specification for trolley wire, No. 23, which was published in 1905, a series of Specifications drawn up jointly by the Municipal Tramways and Transport Association and the Tramways, Light Railways and Transport Association has been taken as a basis, and the new Specification is now the most stringent in existence for this class of material. It takes full account of the great strides that have been made in recent years by cadmium-copper wire; hard-drawn copper and bronze are also recognised as standard materials. The Specification provides for both round and grooved sections of wire, and the range of sizes extends from the smallest tramway trolley wire to the largest railway contact wire. The standard dimensions of the trolley wheel groove are also given. Copies of this revised Specification (No. 23-1933) may be obtained from the Publications Department of the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Fatality

A case of death resulting from touching a stay-wire connected with a pole carrying overhead 230-V cables was investigated by the Wiltshire Coroner (Mr. A. L. Forrester) at an inquest held at Bratton last week on John Newbury, a gardener. Newbury was rolling a lawn, and was found lying dead near a stay-wire which ran down into the lawn. Sitting with the Coroner was Mr. K. Preston, M.I.E.E., H.M. Electrical Inspector of Factories. The deceased's employer, Mr. Jameson, after finding the body, himself touched the wire lightly and received a slight shock. Mr. E. Jordan, district manager and engineer for the West Wilts Electric Light & Power Co., said he found the stay definitely "alive." The "jumper" connecting two lines of cable was touching a D-iron which was holding one of the branch cables. This D-iron had turned from its normal horizontal position to such an extent as to come into contact with the cable. The pole carried four main cables. It was a junction pole for the Tinhead supply, and the branch wires were carried on brown insulators, held by the D-irons bolted through the pole, and fastened at the back of the pole by nuts. One of these nuts was in contact with the stay-wire. To his knowledge there had never been a similar accident. The pole was inspected a fortnight earlier, following the gale, and no adverse report was received. Since 1930 stays had been insulated.

Upon the jury's findings, the Coroner entered a verdict that "the cause of death was electrocution through touching a stay-wire to a low-pressure electric pole, which was not insulated according to Government regulations."

Appointments Vacant

Chief engineer and manager for Government Electrical Undertakings, Ceylon.

City electrical engineer for Lincoln.

(See our classified advertisements.)

A New Use for Cooling Water

Cheltenham Corporation Improvements Committee has inspected the cooling ponds of the power station and has asked the borough surveyor to prepare an estimate for forming one of the ponds into a swimming bath.

Makers' Names Wanted

ULTRALUX U9 fitting.
ARTSUN electric lamps.
STAG time switch.
UNIVAC vacuum cleaner.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. W. J. Bache, the borough electrical engineer of Cheltenham, is recommended by the Electricity Committee for an honorarium of £500 for his services in connection with the change-over of the system of supply in Cheltenham.

Mr. and Mrs. William Tayler, of Ashford, Kent, celebrated their golden wedding on March 24th. Mr. Tayler has for many years been in business as an electrical engineer in Ashford.

Mr. S. Farrer, of Messrs. Ferguson, Pailin, Ltd., has been nominated as chairman of the North-Western Students' Section of the Institution of Electrical Engineers, and **Mr. J. H. Pirie,** of Messrs. W. T. Glover & Co., Ltd., has been nominated as vice-chairman.

Mr. C. E. Allsopp was elected chairman of the Bradford Circle of the British Electrical Development Association at the annual meeting held on March 28th.

Miss H. M. Lane, of the North Wales Power Co., Ltd., who won the E.D.A. Public Speaking Competition (Ladies' Contest) with a speech on "Electric Cooking—its Advantages"

Mr. J. C. Little, of Newcastle-upon-Tyne, has been elected president of the Amalgamated Engineering Union in succession to Mr. W. H. Hutchinson.

Mr. S. Schneider (British Electric Domestic Appliances, Ltd.) has changed his name by deed poll to Stanley Frederick Sheridan.

Mr. L. E. Knowlman, of Oundle, Northants, has been recommended by the Oxford Corporation Electricity Committee for the appointment of assistant engineer in the electricity consumers' department.

Mr. J. E. Nelson, of the Mersey Power Co., Runcorn, has been elected vice-chairman of the Runcorn Chamber of Commerce.

Ald. H. J. Galliers was elected chairman of the Wireless Retailers' Association at the recent annual meeting of the National Council. Ald. Galliers established his electrical engineering and contracting business at Brighton in 1900, and now has branches at Worthing, Lewes, Haywards Heath, and in London. He was responsible for the formation of the Sussex branch of the Electrical Contractors' Association in 1919, and was elected chairman of the branch in 1922 and 1923. He has been a member of the Council of the E.C.A. since 1924, and was chairman of the Southern Section in 1928. He was mayor of Brighton for the year 1928-29.

Mr. W. Kells has been appointed Liverpool branch manager of Messrs. W. T. Henley's Telegraph Works Co., Ltd., in succession to **Mr. J. B. Snell,** who has resigned from the position in order to take up an important appointment with a large supply undertaking. Mr. Kells joined the company in 1910, and served in the army from 1917 to 1919. On demobilisation he resumed his duties at the company's Liverpool branch, and was appointed chief assistant at that branch in April, 1922.

Mr. W. Kells

Dr. Wolfgang Gaede has been awarded the tenth Duddell Medal by the Physical Society Council.

Mr. Thomas Birkett has been elected to the board of the Midland Electric Manufacturing Co., Ltd.

Mr. J. A. Walker, advertising manager of Messrs. Ruston & Hornsby, Ltd., has severed his connection with the company, and **Mr. W. H. Temple,** who until recently was in the Publicity Department of Agricultural & General Engineers, and was formerly with Messrs. Aveling & Porter, Ltd., has been appointed head of the Publicity Department. Mr. Temple will take up his duties about the middle of this month.

Mr. R. M. Codd, a constructional engineer with the Western Electrical Supply Co., was married at Bideford on March 25th to Miss Mary Milsom, of Bideford.

[*Elliott & Fry.*

Mr. F. H. Taylor

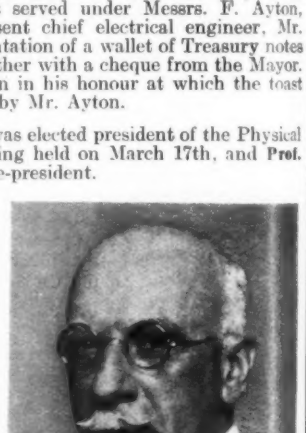
Mr. F. H. Taylor, A.M.I.E.E., has recently retired from the Willesden Polytechnic, after thirty-four years' service in the Department of Electrical Engineering. In February, 1902, he founded the Willesden Polytechnic Electrical Engineering Society, which was dissolved at the annual meeting held on March 25th. At the annual dinner, which followed, Mr. F. Twirdy made a presentation, on behalf of the Society, to Mr. Taylor, as president, as a token of their appreciation for all that he had done for the Society, and in recognition of his work at the Willesden Polytechnic. Mr. Taylor has now set up as a consulting engineer at 19, Old Queen Street, Westminster, S.W.

Mr. R. W. L. Harris has been nominated for election as chairman of the North-Eastern Students' Section of the Institution of Electrical Engineers for the 1933-34 session, and **Mr. E. C. Rippon** has been nominated as vice-chairman.

Mr. W. A. Fairhead, power station superintendent, has retired from the service of the Ipswich Corporation Electric Supply and Transport Departments. After an adventurous life at sea, Mr. Fairhead joined the Sunderland Electricity Department in 1901, and after three years there went to Ipswich to take up the position he has just relinquished. During this period he has served under Messrs. F. Ayton, A. S. Black, and the present chief electrical engineer, Mr. H. E. Blackiston. A presentation of a wallet of Treasury notes has been made to him, together with a cheque from the Mayor. A dinner was recently given in his honour at which the toast of his health was proposed by Mr. Ayton.

Professor A. O. Rankine was elected president of the Physical Society at the annual meeting held on March 17th, and **Prof. W. Wilson** was elected vice-president.

Mr. W. Lang, M.I.E.E., of Callender's Cable & Construction Co., Ltd., has been elected president of the Batti-Wallahs' Society for the ensuing year. Mr. Lang received his electrical training in 1888 as an apprentice in the electrical department of Messrs. Wm. Denny & Bros., Dumbarton, and subsequently was electrician on board R.M.S. *Ruahine*, of the New Zealand Steamship Co. The dynamos on this ship were driven by Tower spherical engines, an interesting and novel type which has not survived except among the exhibits of the South Kensington Museum. He studied under Professor Andrew Jamieson, Glasgow and West of Scotland Technical College, and after spending four and a half years in Boston and New York, returned in 1899 to Messrs. James Milne & Son, Ltd., Edinburgh. From there he went to the James Keith & Blackman Co., Ltd., and finally joined Callender's in 1905.



[*Elliott & Fry.*

Mr. W. Lang, the Batti-Wallahs' new president

Obituary

Mr. R. Lomax.—The death occurred on March 31st of Mr. R. Lomax, engineer and manager of the Hazel Grove and Bramhall Urban District Council Electricity Department. Mr. Lomax went to Hazel Grove as temporary engineer in April, 1930, and was appointed engineer and manager in February, 1931. He was formerly borough electrical engineer at Stockport.

Mr. W. R. E. Boyd.—The death of Mr. W. R. E. Boyd, formerly manager of the Irish branches of the General Electric Co., Ltd., occurred on March 23rd at St. George's Nursing Home, London. Mr. Boyd, who was in his fifty-eighth year, was connected with the G.E.C. for a period of twenty-seven years, resigning in 1927. His death occurred from pneumonia, following a short illness.

Mr. R. Orsettich.—The death occurred on March 31st of Mr. Robert Orsettich, of Sutton Coldfield (aged 57), who had been the engineer of the engineering works at Witton, Birmingham, of the General Electric Co., Ltd., for the past thirty years. He was largely responsible for the development of the engineering side of the company from its earliest beginnings. He was born at Trieste and was educated at the University of Vienna, after which he served with Lahmeyer and Siemens Schuckert; he represented the latter concern at the Paris Exhibition in 1900. Before joining the G.E.C. he was chief draughtsman for Armstrong-Whitworth, Ltd., which post he held for several years. There was a large and representative attendance of the electrical industry at the funeral on Tuesday at Sutton Coldfield Cemetery. Those present included Mr. M. J. Railing (joint managing director and general manager, G.E.C.), Dr. A. H. Railing, Mr. G. H. Ide, Dr. C. G. Garrard, Mr. H. W. Richardson, Capt. J. I. Cheshire, Mr. Gregory Smith, Mr. R. Dumas (B.T.-H. Company), Mr. E. Wilson, Mr. W. S. Sprague, Mr. J. B. Kramer, Mr. N. Martin, and Mr. F. Somers. The local centre of the Institution of Electrical Engineers was also largely represented.

Mr. J. E. Roberts.—The death is announced of Mr. J. E. Roberts, A.M.I.E.E., which occurred at Egremont, Cumberland, on March 24th. Mr. Roberts was formerly electrical superintendant at the central station, Aldershot, prior to which he was with the British Thomson-Houston Co., Ltd., and other well-known companies.

Mr. W. Vause.—The death is announced, at the age of fifty-five years, of Mr. William Vause, who for some years had been on the staff of the English Electric Co., Ltd., at Rugby.

Wills.—Mr. H. V. Wynne Roberts, director and sales manager of the General Electric Co., Ltd., left £18,792 (net personalty £15,937).

Mr. Andrew Davidson, chief electrical engineer of Dorman Long & Co., left £11,277 gross, and £10,052 net.

New Books

Electrical Engineering Laboratory Manual, by S. PARKER SMITH. Pp. 153; illus. Oxford: The University Press. Price: 3s. 6d.

This manual represents work performed in the Electrical Engineering Department of the Royal Technical College, Glasgow, and the instructions given are based on the requirements of the students and the equipment of the laboratories there. It could, however, with modification, be employed in any other college of similar standing. The experiments, ninety-two in number, deal with d.c. machines, transformers, polyphase induction motors, synchronous machines, converting plant, and single-phase motors. The tests given are in most cases fairly exhaustive, though single-phase motors deserve a little more space than they have been accorded, and some important tests are only mentioned, no instructions for performing them being given.

The first thirty-six pages deal with such matters as laboratory routine, instruments, and standard tests, and this section may be considered one of the most important in the book. The hints given here point the way to sound experimental work. A certain amount of criticism might be made of some of the tests. The curves in Fig. 21 should be marked "contact resistance" and "contact drop," and the curve of the latter seems to have a peculiar shape. An important method of resistance measurement, that of substitution, is not mentioned. The "kick" method of determining the brush position is better than the one described on p. 39, and several other matters require amendment.

Electric Wiring for Lighting and Power Installations, by ARTHUR L. COOK. Pp. 463; figs. 249. London: Chapman & Hall. Price: 18s. 6d.

This is the third edition of a popular American handbook on wiring. The former issues were entitled "Interior Wiring and Systems for Electric Light and Power Service." Alterations in method and in the National Electrical Code have made it necessary to revise a large proportion of the text. The wiring systems, the cable sizes, and the nomenclature of accessories differ from British practice, and on that account this book is apt to be confusing to the average wireman in this country. On the other hand, the American National Code is more detailed and definite than our own I.E.E. Wiring Regulations, and a close study of a standard American handbook such as this is of real value to the English student or engineer—especially to those concerned with the arrangement of large installations. The text-book is thorough and practical. It is profusely illustrated and provided with useful charts. A good feature for the student is the set of "problems" relative to each chapter.

Principles of Industrial Management, by E. A. ALLCUT. Pp. 218; figs. 57. London: Sir Isaac Pitman & Sons, Ltd. Price: 10s. 6d. net.

This book should be interesting to those who wish to obtain some general knowledge of the principles of factory management, and as a reference book it is worthy of a place on the shelves of the student of principles of management, but is not likely to appeal to the practical business man. The author, who is a Professor of Mechanical Engineering in the University of Toronto, points out that the book was written primarily for use by students as a textbook, and it fulfils this object well.

The book covers production management in the wide sense, embracing such associated subjects as time and motion study, planning, costing and payment of labour, but no attempt is made to deal with the broader problems of management outside the factory, and financial management and marketing are ignored. The book is well illustrated, but the allocation of space to the various aspects of factory management is definitely not in proportion with their practical importance.

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Shorter Notices

"Conduction of Electricity through Gases," by Sir J. J. Thomson and G. P. Thompson. Cambridge University Press. Price 30s.

"What's Needed." Pp. 65. London: Institute of Patentees. Price 1s.—A list of 895 needed inventions. Nearly eight pages are devoted entirely to electrical inventions, mainly of a domestic nature.

"Eclipse of British Sea Power," by Sir Archibald Hurd. Pp. 41. London: *The Shipping World.* Price 2s.

"Erdung, Nullung und Schutzschaltung nebst Erläuterung zu den Erdungsatsätzen," by Oskar Löbl. Berlin: Julius Springer. Price RM.9.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Water Heaters, Ltd.—Public company. Registered April 3rd. Capital £21,000 in 20,000 8 per cent. participating preference shares of £1 each and 20,000 ordinary shares of 1s. each. Objects: To adopt an agreement with G. Marshman, and to carry on the business formerly carried on by him and that of manufacturers of and dealers in water heaters, geysers, boilers, systems for heating water by gas, electricity, oil or any other means, &c. The subscribers are: R. W. Brown, 20, Claverton Street, S.W.1, H. G. Arundel, 54, Haymarket, S.W.1, and five others. The first directors are: G. Marshman, of 182, Walmersley Road, Bury, and two others to be appointed by him. Registered office: Dorland House, 14, Regent Street, S.W.1.

Belgrave Electric Co., Ltd.—Private company. Registered March 23rd. Capital, £3,000 in 2,800 ordinary and 200 cumulative preference shares of £1 each. Objects: To acquire the business now carried on at 24, Belgrave Road, S.W.1, as the Belgrave Electric Co., and to carry on the business of manufacturers of and dealers in electric lamps, wireless valves, apparatus and appliances, &c. The permanent directors are: R. H. Quinnell, Rowhurst, Leatherhead; W. Foster, 24, Belgrave Road, S.W.1; and V. M. I. Quinnell, Rowhurst, Leatherhead. Registered office: 24, Belgrave Road, S.W.1.

Graeme E. Robson, Ltd.—Private company. Registered April 3rd. Capital £2,000 in 1,000 preference shares of £1 each and 4,000 ordinary shares of 5s. each. Objects: To acquire the business of radio consultants, wireless service engineers, manufacturers of precision test meters, &c., carried on at 44, Norwood Road, S.E., as "Graeme E. Robson." The life directors are: G. E. Robson, 41, Harpenden Road, West Norwood, S.E.27, R. F. Knight and A. F. Knight, both of 9, Church Road, Brixton Hill, S.W.2. Registered office: 44, Norwood Road, S.E.24.

Hatch End Electrical Co., Ltd.—Private company. Registered March 30th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, wireless, mechanical and general engineers and engineering contractors, &c. The directors are: W. W. Symper, Oakley, Northwicke Park Road, Harrow; and J. H. Liddle, Lindisfarne, Parkside Way, North Harrow. Secretary: A. H. Ingledon Hearn. Registered office: 16, Broadway Parade, Hatch End, Middlesex.

J. G. Smithson & Co., Ltd.—Private company. Registered March 30th. Capital, £6,000 in £1 shares. Objects: To carry on the business of electricians, mechanical, electrical, and general engineers and contractors, suppliers of electricity, &c. The directors are: J. G. Smithson, Oakdale, Alvechurch, Birmingham; J. C. Graham, 39, Havelock Road, Handsworth, Birmingham; and R. W. Purdie, address not stated. Solicitors: Wragge & Co., 4, Bennetts Hill, Birmingham.

Fullick & Loosley, Ltd.—Private company. Registered April 1st. Capital £1,000 in £1 shares. Objects: To acquire the business of electrical contractors and radio and electrical engineers carried on at the Broomfield Garage, Broomfield Road, West Ealing. The permanent directors are: J. E. Loosley, 89, Bramley Road, Ealing, W., and three others. Registered office: 55, Eccleston Road, Ealing, W.13.

D. L. Topps, Ltd.—Private company. Registered April 1st. Capital £1,000 in £1 shares. Objects: To carry on the business of electrical, wireless, mechanical, motor and general engineers, &c. The subscribers are: D. L. Topps and Edith Topps, both of 553, Liverpool Road, Irlam.

Returns of Electrical Companies

Prentice, Ltd.—Capital, £15,000 in 5,000 ordinary and 5,000 preference "A" and 5,000 preference "B" shares of £1. Return dated December 28th, 1932. 5,000 ordinary, 3,300 preference "A" and 3,305 preference "B" shares taken up. £1,607 paid on two ordinary, 800 preference "A," and 805 preference "B." £9,998 considered as paid on 4,998 ordinary, 2,500 preference "A," and 2,500 preference "B." Mortgages and charges, nil.

British G.W.Z. Battery Co., Ltd.—Mortgage debenture dated March 22nd, to secure £1,400, charged on the company's undertaking and property, including uncalled capital. Holders: Batterie und Elementemfabrik Koch und Kruger G.m.b.H., Berlin. Particulars also filed of £5,000 debentures authorised March 22nd, charged on the above mentioned property, the whole amount being now issued.

Yale Electric Power Co., Ltd.—Capital, £20,000 in 3,300 preference shares of £1 and 668 ordinary shares of £25. Return dated December 7th, 1932. 1,000 preference and 668 ordinary shares taken up. £16,000 paid on 1,000 preference and 600 ordinary shares. £1,700 considered as paid on 68 ordinary shares. Mortgages and charges, £2,786 (overdraft).

Cecil Cooper & Co. (London), Ltd.—Assignment of a debt due to the company dated March 20th, to secure sums due to charges in respect of legal costs not exceeding £300. Holders: G. A. Wingfield, L. A. Wingfield and J. H. L. Trustram, practising as Wingfield, Halse & Trustram, of 61, Cheapside, E.C.2.

Naider Bros. & Thompson, Ltd.—Satisfaction in full on October 7th, 1931, of Land Registry Charge dated May 19th, 1924, and registered May 19th, 1924. (According to the register of mortgages, the charge registered May 19th, 1924, originally secured all moneys due to bank.) Notice filed March 28th, 1933.

Adelaide Electric Supply Co., Ltd.—Capital, £3,000,000 in £1,750,000 preference stock, £750,000 preferred ordinary stock, and £500,000 ordinary stock. Return dated December 1st, 1932. All stock taken up. £2,870,000 paid. £130,000 considered as paid. Mortgages and charges, £1,643,853.

Climax Electric Co., Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1. Return dated December 31st, 1932. 1,078 preference and 3,039 ordinary shares taken up. £1,617 paid. £2,500 considered as paid. Mortgages and charges, nil.

National Lighting Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1932. All shares taken up. £800 paid. £200 considered as paid. Mortgages and charges, nil.

East India Tramways Co., Ltd.—Capital, £109,091 in 7,524 preference, 1,567 ordinary, and 100,000 deferred shares of £1 each. Return dated December 15th, 1932. 100,000 deferred shares taken up. £100,000 considered as paid. Mortgages and charges, nil.

Ingleton Electric Lighting and Power Co., Ltd.—F. Harrison, Permanent Chambers, Piece Hall Yard, Bradford, was appointed receiver and manager by Order of Court dated February 21st.

Lancashire Telephone Systems, Ltd.—Issue on December 21st, 1932, of £350 debentures, part of a series already registered. (Particulars of issue filed March 24th, 1933.)

Phœnix Dynamo Manufacturing Co., Ltd.—Capital, £100 in £1 shares. Return dated January 12th, 1933. Two shares taken up. £2 paid. Mortgages and charges, nil.

Rectifiers, Ltd.—Capital, £2,000 in £1 shares. Return dated December 28th, 1932. 1,556 shares taken up. £1,556 paid. Mortgages and charges, nil.

Nivalight (1928), Ltd.—Capital, £500 in £1 shares. Return dated November 17th, 1932. All shares taken up. £5,000 paid. Mortgages and charges, nil.

City Notes

Bruce Peebles & Co., Ltd., report that the trading for 1932 was unsatisfactory. The continued heavy depression both in the home and export markets has further decreased the volume of orders, especially from the electricity supply authorities, from which the major portion of the company's business has hitherto been obtained. The trading loss for the year, including that of the Canadian subsidiary, after deducting £19,522, being the balance of certain reserves which are not now required, is £14,444 (against a loss of £7,796 in 1931). A balance of £380 is brought in, and £14,500 is transferred from general reserve, leaving a credit balance of £436 to be carried forward. The directors do not recommend any dividend for the past year on either the preference or the ordinary shares. The report states that the company is endeavouring to extend its business by concentrating on the production of electrical plant for general industrial purposes, redesigning all standard products, and developing new lines. Since the end of the year it has been decided to close the Canadian subsidiary on March 31st, and in conjunction with three other leading British manufacturers, to establish a new joint selling company in Canada. It is expected this will reduce materially the working costs and improve considerably the results of trading in Canada. To provide for the further losses of the Canadian company prior to April 1st, at which date the new arrangement took effect, the necessary amalgamation sacrifices on the part of this company (in common with the other companies) on plant and stocks and the company's share of the formation expenses, the board has decided to set aside from general reserve the sum of £6,000, thus reducing it to £45,500. Mr. G. L. Kirkpatrick, M.I.E.E., has been appointed general manager. Whilst the directors anticipate an improvement in the results for the year 1933 in consequence of the reorganisation which has taken place during the latter part of the preceding year, competition for the limited business available will continue to be abnormally severe, and it is impossible to predict the effect of this upon the turnover. Meeting: Edinburgh, April 12th.

The Bournemouth & Poole Electricity Supply Co., Ltd., held its annual meeting on April 4th, Sir Bernard E. Greenwell, Bt. (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, March 31st, p. 472), the chairman said that the Act of Parliament which they promoted jointly with the local authorities came into force during the year, and with that there were introduced reduced prices to consumers, in consideration for which the company obtained an extension of tenure for twenty-one years in respect of the districts of Bournemouth, Poole and Christchurch. Even so, the results for the year were again satisfactory, and reflected the continued expansion of their business. They had added during the year a total of seventy-one miles of h.p. and l.p. transmission lines to their distribution system, and had changed a considerable portion of the area to the 50-cycle standard system. The sales of electricity in 1932 were more than double those for 1927, and represented an increase of 16.8 per cent. over those of the preceding year. The increased sales were due to a large extent to the success of the two-part tariff system. The average rate obtained under the domestic two-part tariff for all purposes was 1.6d. They had introduced a system of assisted-wiring installations which had had a good reception among their consumers, and at the moment they were erecting new showrooms to meet the rapid growth of their business. In the areas under the two Wimborne Orders, there was an increase of over 54 per cent. in the electrical energy sold, as compared with the preceding year, and an increase of 63 per cent. in the number of consumers connected. For the first two months of the current year the sales of electricity showed an increase of over 17 per cent., and there was also a large increase in the number of consumers connected.

The British Aluminium Co., Ltd., held its annual meeting on March 31st, when Mr. R. W. Cooper (chairman), who presided, in the course of his speech said although there had been a reduction during the year in the tonnage of their total sales, they had had the compensating advantage of an increased percentage of these sales being made in the form of rolling-mill products, and in fact the weight of these products disposed of was in advance of similar sales during the preceding year. The exports of aluminium in all forms suffered additional contraction during the year, which was made up for in part only by improved home sales, the saving in freight forming a contribution towards maintenance of profits. In the electrical industry the grid was now practically complete, and before the end of the current year it was expected that nearly 20,000 miles of overhead steel-cored aluminium conductor would be erected and in service. The economic success of the grid depended on a widely extended consumption of electricity which would necessitate the construction of thousands of miles of low-voltage lines, for many of which they hoped aluminium would be used. Work under the contract for the construction of the second stage of the hydro-electric works at Lochaber had made good progress. The excavation of the tunnel was completed in October last, and the construction of the dams to form the Loch Laggan and Loch Treig reservoirs was proceeding. The average number of men employed upon the scheme during the year was 1,050.

The Anglo-Portuguese Telephone Co., Ltd., held its annual meeting on March 29th, Sir Alexander Roger (chairman) presiding. In presenting the report and accounts (ELEC REV., March 24th, page 437), the chairman said that like other concerns they were taking advantage of the present era of cheap money in this country to reduce the interest on their prior charges. It was particularly desirable that a telephone company should have a continuous supply of new capital at low rates of interest, because the demand for expansion was always present. They had spent over £500,000 during the past five years on capital account in the extension and modernisation of their system. The policy had been justified, as over the same period the number of stations had advanced from 21,127 to 33,086. The strength of their position would enable them to satisfy all further requirements for the extension and development of the telephone service, involving the provision of additional capital. The satisfactory development which had taken place was due to a large extent to their systematic propaganda and their scheme for the payment of installation fees and rentals by instalments. Unemployment in Portugal had not assumed the same proportions experienced in other countries, and the number of unemployed was under one per cent. of the population. The company's relations with the Government and the municipal authorities continued to be of the most friendly character.

The English Electric Co., Ltd., reports that the results of the year 1932 necessitate carrying forward a balance to the debit of profit and loss account. This result is due to the unprecedented conditions which have encompassed world trade. The position has also been adversely affected by the restricted capital development expenditure on the part of public authori-

ties at home. The manufacturing efficiency of the company has been still further improved during the year and the manufacture of additional classes of apparatus has been proceeded with. The result of this is that the company is in a position to deal effectively with a wider range of business than hitherto. No provision has been made for depreciation this year, but the plant, machinery and buildings have been well maintained out of revenue. The trading profit for the year, after crediting normal and special dividends receivable from Willans & Robinson, Ltd., amounted to £106,196, as compared with £209,394 in 1931. After deducting debenture interest, &c., and adding £2,474 brought in, there is a loss of £9,433, as against a net profit of £34,086. The report records the death of Mr. F. Massingberd Rogers, a director, and the resignation from the board of Mr. V. Watlington. Since the end of the year Sir Holberry Mensforth has resigned the chairmanship of the board, but remains a director. Mr. G. H. Nelson, in addition to his duties as managing director, has been appointed deputy chairman. During the year Mr. J. H. Gannon was appointed a director. Meeting: April 11th.

The South London Electric Supply Corporation, Ltd., held its annual meeting on April 4th. Lord Gainford (chairman), who presided, in presenting the report and accounts (ELEC. REV., March 31st, p. 472), said that the company had again shown continued growth during the past year, which was reflected by the increase of 2,110,705 kWh in sales for 1932, as compared with 1931, the total being 36,015,528 kWh. They still awaited the approval of the new standard prices which would have effect from January 1st, 1932. These had to be concurred in by the London & Home Counties Joint Electricity Authority, and approval was only withheld on a few unimportant points, which had been remitted to the Electricity Commissioners for their decision. A satisfactory increase of business was shown for the first few months of this year over the corresponding period of last year, and the scheme for assisted wiring in the area was meeting with much success. It was important to note that their area was in the main industrial, but the activities were so diverse that the effect of trade depression had not been felt by the company so severely as might have been expected. Actually there was an increase of nearly 2 per cent. last year in their output for industrial purposes.

Telephone Properties, Ltd., reports a net profit for 1932 of £33,244, to which is added £8,066 brought in, making £41,310. It is proposed to pay a dividend of 8 per cent. on the ordinary shares, and to carry forward £5,696. In December last the company purchased from the Telephone & General Trust, Ltd., for cash consideration of £315,208, Bs. 7,580,000 nominal of 8 per cent. first mortgage bonds of the Compania Anonima Nacional Telefonos de Venezuela, such bonds ranking for interest as from January 1st last. Simultaneously the company created £300,000 of 6 per cent. first mortgage debenture stock. At December 31st. 1932, £150,000 of the stock had been allotted for cash to the Telephone & General Trust, Ltd., at £99 per cent., and there had also been allotted for cash to the Trust 151,553 8 per cent. cumulative preference shares of £1 each at a price of 22s. per share. Meeting: April 12th.

The Great Northern Telegraph Co. (Ltd.), of Denmark.—In order to make possible a total dividend and bonus of 20 per cent. (including the five per cent. already paid) for the year 1932, the directors propose to transfer Cr. 4,500,000 (£233,161) from interest on reserves to the revenue account, whilst no contribution from net profits to reserves is proposed. To the pension fund has been allotted Cr. 700,000 (£36,269). It is further proposed to carry forward Cr. 9,884,200.51 (£512,135) to the accounts for 1933 and to carry over from the balance sheet an additional sum of Cr. 1,095,413.75 (£56,757), being profit from the sale of shares in other undertakings.

Associated Electrical Industries, Ltd., reports a profit for 1932 of £474,359, as compared with £356,479 in the preceding year. After providing for debenture interest, depreciation, and income tax, there is a balance of £223,453, to which is added £99,899 brought in, making £323,352 available. The ordinary dividend is maintained at 4 per cent., but on larger capital, and a balance of £102,415 is carried forward. The trading results include profits from the subsidiary companies to the extent to which dividends have been declared. The report states that due to the continued industrial and financial depression throughout the world the orders received during the year were less than in the previous year. Orders in hand at the end of the year also showed a decrease. Mr. W. C. Lusk, the deputy chairman, has been appointed managing director. Meeting: April 6th.

Vince's Dry Batteries, Ltd.—The subscription list was opened on Tuesday last in an issue of 500,000 10 per cent. participating preferred ordinary shares of 2s. each at par. It was reported on the following day that the issue had been oversubscribed. The prospectus states that the demand for the company's products is greatly in excess of the output, and the present issue is being made to enable the company to acquire the freehold of Garford Works, to carry out the necessary alterations thereto, to install additional plant and automatic machinery capable of turning out 60,000 h.t. batteries and 100,000 pocket lamp batteries per week, and to provide further working capital.

The Gateshead and District Tramways Co. reports a revenue for 1932 of £116,400, a decrease of £3,934 as compared with the previous year. Expenses, including mortgage interest and £10,000 placed to the renewals account, amounted to £94,311, and the net profit is £22,088 (against £21,485), which with £23,443 brought in makes £45,531. A dividend of 6 per cent. is paid on the ordinary shares and £23,467 is carried forward. Meeting: April 11th.

The Rangoon Electric Tramway & Supply Co. reports a net profit for 1932 of £58,366, as against £77,012 in 1931; to this is added £28,842 brought in, making £87,209. The final ordinary dividend is 14 annas per share, free of Indian tax, making Rs.1-4-0 for the year (against Rs.1-8-0), and £26,375 is carried forward.

The River Plate Electricity Co. reports a net revenue for 1932 of £49,248 (against £52,685 for 1931); to this is added £8,290 brought in, making £57,538. It is proposed to pay a dividend of 10 per cent., less tax, on the ordinary shares (against 10½ per cent.), to place £5,000 to general reserve, and to carry forward £10,163.

The Woking Electric Supply Co., Ltd., reports a profit for 1932 of £55,554, to which is added interest and £1,604 brought in making £57,836. The ordinary dividend is 10 per cent., tax free, and £1,329 is carried forward. The number of consumers at the end of the year was 9,026, as against 7,424 in 1931.

The Tamworth District Electric Supply Co. reports a net profit of £5,410 for 1932 (against £4,910 in 1931), to which is added £1,292 brought in. The final ordinary dividend is 4 per cent., making 6 per cent. for the year, plus a bonus of 1 per cent., and £1,411 is carried forward.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved: Deal and Sandwich Electrical Co., Ltd.; Hightensite & Ebonite Manufacturing Co., Ltd.; Orford Electric Light & Power Co., Ltd.

Parkinson & Cowan, Ltd., announce that payment of the preference dividend, which fell due on March 31st, and of the arrears of dividend, is deferred pending the completion of the accounts for the nine months to December 31st last.

Stewarts & Lloyds, Ltd., have declared the usual dividends on the various classes of preference capital, but do not recommend any distribution on the deferred and liaison deferred shares.

International Telephone & Telegraph Corporation.—It is reported that at the annual meeting held on March 16th no dividend action was taken by the directors.

The Jarrow & District Electric Traction Co., Ltd., reports a profit of £2 for 1932, which has been set against the loss of £108 brought in.

The Tynemouth & District Electric Traction Co., Ltd., reports a surplus for 1932 of £250, as against £6,979 in 1931, which, with £1,044 brought in, is carried forward.

Aktiebolaget Elektrolux, of Stockholm, reports a net profit of Kr. 7,045,370 for 1932, as against Kr. 7,073,324 in 1931. A dividend of Kr. 8 per share is recommended.

The Montreal Light, Heat & Power Consolidated has declared a quarterly dividend of 37 cents per share (same).

The Oxford Electric Co., Ltd., has declared an ordinary dividend of 7 per cent., less tax, for the year (same).

Stocks and Shares

TUESDAY EVENING.

WEEK by week the tale has to be repeated of easy money conditions, and the difficulty that prevails in employing capital at living rates of interest. The plethora of cash is having, however, the effect of quickening the stream of new issues, and of putting on the *qui vive* borrowers of all classes, from those who have the most gilt-edged stocks to offer, to those whose securities are the reverse of secure. There is still a mild form of restriction imposed by the Government upon new issues, but this is not of sufficient importance to make any great difference to the offering of stocks and shares for the consideration of the investor. That same investor is showing a nice discrimination in his choice of securities. Many people still prefer the older-established investments, and the prices of these latter are well maintained, without there being any particular further advance during the past business week. The approach of Easter lays something of a restraint upon business in the Stock Exchange, where, however, events of interest crop up with an almost remarkable frequency, leading to unexpected developments and, occasionally, to violent changes in prices.

The Canadian "Incident"

The unprecedented course was pursued in the Stock Exchange last Friday of removing from the pages of the *Stock Exchange Daily Official List* nearly all the stocks, shares, bonds, &c., associated with Canada. The reason lay in the fact that Canada has proposed a new 5 per cent. tax, to be levied upon non-resident holders of Canadian securities. This was taken at first to include Canadian stocks and shares, other than those of the Canadian Government, of all kinds. Subsequent explanation showed this to be a mistaken impression, and the quotations for the various issues were accordingly reinstated after having been absent for one night. The incident has aroused a shade of uneasiness, although cool consideration contended that neither Canada nor any other country is likely to consent to a measure that would sail fairly close to confiscation.

Home Railway Stocks

The principal feature in the market for transport issues is the strength shown by the pre-ordinary stocks. Improvements of a point apiece have lifted to 62¼ the ordinary stocks of the Central London, City & South London and London Electric Railways. Districts are 2 higher at 63¼. Metropolitans retain their previous rise to 71¼, and Underground Electrics to 19s. 6d. In the prior-charge stocks, Central London 4½ per cent. preference shows a gain of 2 at 100½, and there are some useful advances in the group of London tramway securities. Metropolitan Electric Tramway 4½ per cent. debenture at 112½ is up 2 points, and the company's 5 per cent. debenture is 5 higher at 113¾. London & Suburban Traction first debenture at 112¼ shows a gain of 2. London General Omnibus first debenture has advanced to the same figure. As may be surmised, these improvements indicate a demand which it is

exceedingly difficult to satisfy. The demand is based upon the anticipated prices of the stocks which will be given, in exchange for existing securities, when the London Passenger Transport Bill finally becomes law.

Dollar Stocks

Financial affairs in America are declared by some of the financial authorities to be at their lowest ebb. This statement has been made week by week for some time past, its value being somewhat dimmed by the monotonous regularity with which prices fall. American Telephone & Telegraph stock, which shed 17½ points last week, is another 2 lower at 130½. International Telephones are 8½. Consolidated Gas of Baltimore, after its drop of 10, has receded a further 5½ points to 64¼. South Eastern Power & Light at 70 is several points down. Pennsylvania Water & Power at 62½ has lost 20 points on the week. The last occasion on which the shares are officially marked as having changed hands was at the end of November, 1932, the price then being 82½. Postal Telegraph & Cable Corporation 5 per cent. debenture is down 5, at 35. People with money, and with robust confidence in the future of the United States, continue to buy American utilities on each successive fall, convinced that the day will come when affairs in the States take a definite turn for the better, and that the recovery will probably be as rapid as the fall has been prolonged.

Mexican stocks are heavy, Mexican Light & Power first bonds falling 7½ to 67. Mexico Tramway shares are quoted at 7¼, and the company's 6 per cent. 50-year mortgage bonds a point higher at 8¼.

Electricity Supply

The majority of shares in the market for home electricity supply companies are now quoted ex the final dividends for the year ended 1932. It may have been noticed that the quotation of the shares ex dividend has been followed, in a number of cases, by no change being made in the nominal quotations. That is to say, the price cum dividend has been left unaltered when the shares went ex dividend, leaving, of course, a rise equal to the amount deducted. In some cases the price has reflected the deduction. The main point is, however, that very few shares come to market. London Electrics are better at 32s. 6d. North Metropolitan preference at 30s. 6d. are also higher. Amongst the provincial shares, Bournemouth & Poole remain a good market, and have further improved to 73s. 3d. Yorkshire Electrics are 1/8 up at 42s. 6d., and Scottish Power preference at 29s. are better. In the Colonial group, Victoria Falls ordinary strengthened to 4 3/16, Calcutta preference to 27s., South African preference to 28s.

Amongst the debenture stocks, rises have occurred in Edmundson's debenture to 101, Metropolitan Electric first debenture to 107, North Eastern first debenture to 106. Electrical Finance & Securities debenture at 106 is a point up.

Cables and Wireless

There should have been a half-yearly distribution of dividend on Cables & Wireless 5½ per cent. preference paid on Friday in last week. Nothing had been said in advance as to whether the combine intended to close its transfer books, the usual prelude to the distribution of a dividend, but, in spite of this absence of notification, some holders of the stock appear to feel disappointed that the money was not forthcoming at due date. As a consequence, the price of the preference stock fell 3 points to 81½, the "A" ordinary weakening to 26. In view of the chairman's speech last July, it cannot be considered surprising that Cables & Wireless should pass this particular half-year's dividend, though perhaps a payment will be made on account when the figures are available for the year's trading. This might be about June or July next. Globe ordinary receded to 11, the preference to 11¾. Marconi Marines at 28s. 3d. are ex dividend. Anglo-American Telegraph preferred has recovered its slight fall.

Telephone Properties, Ltd., which took over the Venezuela Telephone Company, proposes to pay 8 per cent. dividends on its ordinary and preference shares. The distributions absorb a little more than the company's net profit for the year, and the carry-forward of £5,700 is £2,300 less than the sum brought in from the 1931 accounts.

Manufacturing and Equipment

Associated Electrical Industries has decided to repeat its previously paid 4 per cent. dividend on the ordinary shares. This is regarded as a satisfactory achievement. The price of the ordinary remains unchanged at 17s. 6d., and the preference at 30s. English Electrics are flat at 6s. 3d., and the preference are 4s. 6d. down at 10s. The company's report shows a loss on the year of £9,000. Last year, when the net profit was £34,000, a credit balance of £2,474 was carried forward, and the latter is available for reducing the loss just mentioned. No provision has been made for depreciation this year. Johnson & Phillips are easier at 18s. 3d. Amongst the higher-priced shares, there is no particular change other than 1/8 fall in Enfield Cable ordinary. British Insulated at 70s. have recovered the dividend deduction. Babcock & Wilcox are weak, showing a fall of 4s. 6d. at 32s. 6d., owing to apprehension as to what the dividend is likely to be. The announcement is due within the course of the next few weeks. Vickers gave way to 6s., the chairman at the meeting on Monday in this week taking a rather cautious view of the position.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price, Apl. 4.	Rise or Fall.	Yield. p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	73/3	+9d.	4 1 8
Brompton Ordinary	1	8½	8½	33/6	—	4 3 7
Central Electricity 4½% Deb.	Stock	4½	4½	108	—	4 3 4
Charing Cross Ordinary	1	8½	8½	33/6	—	4 3 7
Chelsea	1	8½	8½	33/-	—	4 4 10
City of London	1	10	10	33/6xd.	—	4 3 7
Clyde Valley	1	8	7	35/-xd.	+6d.	4 0 0
County of London	1	11	10½	53/9xd.	+1/8	3 18 8
Edmundsons' 7% Pref.	1	7	7	30/6	—	4 11 10
Elec. Dis. Yorkshire	1	9	9	45/-	—	4 0 0
Elec. Supply Corporation	1	11	11	66/3	+1/8	3 6 8
Kensington Ordinary	1	8	8	33/-	—	4 4 10
Lancs. Light and Power	1	6½	7	32/6xd.	+6d.	4 6 2
London & Home Counties 4½% Deb.	Stock	4½	4½	108	—	4 3 4
London Electric	1	9	9	32/6	+6d.	4 6 2
Metropolitan	1	10	10	48/9	—	4 2 0
Midland Counties	1	7	7	35/-	—	4 0 0
Mid. Elec. Power	1	8	8	37/6xd.	—	4 5 4
North Eastern Electric Ordinary	1	6	6	30/-xd.	+6d.	4 0 0
Do. 7% Pref.	1	7	7	33/-xd.	+6d.	4 4 10
Northampton	1	10	10	50/-	—	4 0 0
Notting Hill 6% Pref.	10	6	6	13½	—	4 10 7
North Met. Elec. 6% Pref.	1	6	6	30/6	+6d.	3 18 8
St. James' and Pall Mall	1	8	8	32/6	—	4 6 2
Scottish Power	1	8	8	36/3	—	4 8 2
South London	1	8½	8½	33/-	—	4 4 10
Urban Ordinary	1	7	7	38/9	—	3 12 2
Westminster Ordinary	1	8½	8½	32/6	—	4 6 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	17/6	—	8 11 2
Yorkshire Elec.	1	8	8	42/6	+1/8	3 15 3
Home Rails.		1931	1932			
Central London Ord. Assented	Stock	4	4	84½	—	4 14 7
Metropolitan	„	2½	1½	71½	—	2 4 0
Do. District	„	4½	3	63½	+2	4 14 6
Underground Electric	1	7	4½	19/6	—	4 12 4
Telegraph and Telephones.		1930	1931			
American Tel. & Tel.	$100	9	9	130½	—2	6 18 0
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
Do. Def.	„	1½	1½	24	—1	6 5 0
Cables & Wireless 5½% Pref.	„	5½	2¾	81½	—3	3 7 6
Do. A 7½% Ord.	„	—	Nil	26	—2	—
Do. B Ord.	„	—	Nil	11	—	—
Globe Tel. and T. Ord.	10	8½	Nil	11	—¾	—
Do. do. Pref.	10	6	6	11¾	—½	5 2 2
Great Northern Tel.	10	20	20	27	—½	7 8 2
Marconi-Marine	1	15	10	28/3xd.	—	5 6 4
Oriental Telephone Ord.	1	12	12	3	—	*4 0 0
Home and Foreign Trams, Etc.						
Anglo-Arg. Trams First Pref.	5	—	—	1/9	—	—
Do. do. 2nd Pref.	5	—	—	1/9	—	—
Do. do. 5% Deb.	Stock	—	—	5	—1	—
British Electric Traction Def. Ord.	„	5	5	255	—	—
Do. do. Pref. Ord.	„	8	8	135	—	5 18 8
Brazil Traction	100	—	—	9½	—¼	—
Brit. Columbia Elec. Rly. Pfce.	Stock	5	5	102½	—	4 19 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	15/-	—	—
London United Tram Deb.	Stock	4	4	73½	—	5 8 10
Mexico Trams, 5% Bonds	—	5	5	41½	—	12 1 0
Mexican Light Common	100	Nil	Nil	7½	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	67	—7½	7 9 3
Victoria Falls Ord.	1	15	15	4 3/8	+1/8	3 11 6
Yorkshire (West Riding)	1	Nil	Nil	6/-	—	—
Manufacturing Companies.						
Assoc. Elec. Ord.	1	6	4	17/6	—	4 11 5
Do. Pref.	1	8	8	30/-	—	5 6 8
Babcock & Wilcox	1	14	14	32/6	—4/6	—
British Aluminium Ord.	1	10	5	24/6xd.	—6d.	4 1 8
British Insulated Ord.	1	15	15	70/-xd.	+1/6	4 5 9
Brush Ord.	Stock	5	Nil	45	—	—
Callender's	1	15	15	2½	—	5 2 0
Do. 6½% Pref.	1	6½	6½	28/9	—	4 10 5
Crompton Parkinson Ord.	5/-	30	24	21/6	—	5 2 4
Do. 8% Pref.	1	8	8	32/6	—	4 18 6
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	12/-	—	—
Enfield Cable Ord.	1	25	25	4½	—1/8	5 11 1
English Electric	1	Nil	Nil	6/3	—1/8	—
Do. do. Pref.	1	Nil	Nil	10/-	—4/6	—
Ever Ready	5/-	35	35	27/3	+3d.	6 9 6
Ferranti Pref.	1	7	7	23/6	—6d.	5 19 2
G.E.C. Pref.	1	6½	6½	29/9	—	4 7 5
Do. Otd.	1	10	8	41/3	—	3 17 5
Henley's	1	30	30	6½	—	4 16 0
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber	1	Nil	Nil	2/6	—	—
Johnson & Phillips	1	10	5	18/3	—1/8	5 9 7
Siemens Ord.	1	7½	7½	26/3	—	5 14 3
Telegraph Construction	£1	Nil	Nil	18/9	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1931

10612. "Method of limiting interruptions of service in electrical transmission and distribution systems, and a construction of fuses therefor." Schweitzer & Conrad, Inc. July 24th, 1930. (389107.)

24444. "Electromagnetic relays." Rheinisch-Westfälisches Elektrizitätswerke Akt.-Ges. August 29th, 1930. (Addition to 309182.) (389104.)

25204. "Alternating electric current rectifying apparatus of the dry-metal compound type." R. G. Sell and Westinghouse Brake & Saxby Signal Co., Ltd. September 8th, 1931. (389096.)

25221. "Photo-electric cells." Western Electric Co., Ltd. (Bell Telephone Laboratories Inc.). September 8th, 1931. (389097.)

25373. "Voice operated relay circuits." Electrical Research Products Inc. September 12th, 1930. (Addition to 348704.) (389116.)

25374. "Method and apparatus for recording and reproducing electrical signals by means of a magnetic element." Electrical Research Products Inc. April 15th, 1931. (389117.)

25,388. "Electric signalling cables." Standard Telephones & Cables, Ltd. (J. R. Pheazey). September 10th, 1931. (389118.)

25389. "Carrier wave repeater." Standard Telephones & Cables, Ltd. October 18th, 1930. (389119.)

25551. "Electric thermal relays." Aktiebolaget Birka Regulator. September 16th, 1930. (389141.)

25563. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd., and G. A. Mathieu. September 11th, 1931. (389142.)

26481. "Electric discharge devices." British Thomson-Houston Co., Ltd. September 23rd, 1930. (389157.)

26578. "Dynamo-electric machines." International General Electric Co. September 24th, 1930. (389158.)

26670. "Impulse couplings for driving ignition magnetos." Scintilla Magneto Co., Inc. October 4th, 1930. (389160.)

27522. "Electro-thermionic time delay apparatus." British Thomson-Houston Co., Ltd. October 3rd, 1930. (389162.)

28463. "Electric polyphase systems." R. F. C. Peel and Associated Electrical Industries, Ltd. October 13th, 1931. (389164.)

28806. "Working up gases containing hydrocarbons in electric arcs." J. Y. Johnson (I.G. Farbenindustrie Akt.-Ges). October 16th, 1931. (389165.)

29903. "Electric-discharge devices." M-O Valve Co., Ltd., C. G. Eden and C. J. Smithells. October 28th, 1931. (389170.)

30756. "Thermionic valves." Octron, Ltd., and W. Holt. November 6th, 1931. (389176.)

31602. "Electric ignition means for oil burners." Gilbert & Barker Manufacturing Co. November 28th, 1930. (389181.)

33247. "Extensible electric conductors." K. Herkenberg. December 1st, 1931. (389190.)

34065. "Photo-electric cells." Telefunken Ges. für Drahtlose Telegraphie. December 11th, 1930. (389198.)

34354. "Electric and other smoothing irons." J. A. Crabtree. December 11th, 1931. (389200.)

35435. "Electrical heating means for water and other liquids." E. B. Enochsen. December 22nd, 1931. (389210.)

36086. "Electrical heating systems for buildings." G. Jackson. December 31st, 1931. (389216.)

1932

1156. "Automatic telephone and other selective systems employing automatic selectors." Siemens Bros. & Co., Ltd., and W. H. Grinsted. January 14th, 1932. (389223.)

1497. "Radio apparatus." Marconi's Wireless Telegraph Co., Ltd. January 16th, 1931. (389225.)

1505. "Electro-magnetically operated relay devices." E. Symes and Associated Electrical Industries, Ltd. January 18th, 1932. (389226.)

1724. "Automatic telephone systems." Siemens Bros. & Co., Ltd., W. G. Patterson and D. P. Long. January 20th, 1932. (389232.)

1888. "Electric short-wave thermionic valve generators." M-O Valve Co., Ltd., and E. C. S. Megaw. January 21st, 1932. (389233.)

2132. "Electric condensers." R. Postlack. January 23rd, 1932. (389236.)

2288. "Process of and apparatus for the electrical separation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Metallges. Akt.-Ges.). January 25th, 1932. (389237.)

2427. "Switchgear and supports for aerial electrical transmission lines." W. H. Turner and W. H. Isherwood. January 27th, 1932. (389240.)

2806. "Electrodes for carrying out electro-chemical processes and processes of electrolysis employing the same." E. Berl. January 30th, 1932. (389244.)

4114. "Electric insulator pins." H. Rost. February 11th, 1932. (389253.)

4254. "Electric motor controllers." Igranic Electric Co., Ltd. February 12th, 1931. (389254.)

4421. "Method of recording sound by means of a ray of electrons." Dr. H. Von Hartel. February 15th, 1932. (389256.)

4881. "Housings for electrical connections." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. February 18th, 1932. (389259.)

6991. "Electrical pick-ups for gramophones." E. E. Symonds. March 9th, 1932. (389272.)

10286. "Type-printing telegraph systems." A. L. Mond (Watsongraph Corporation). April 11th, 1932. (Convention date not granted.) (389284.)

13581. "Quick-action electric switch." A. F. Bulgin and H. T. Stott. May 11th, 1932. (389305.)

13591. "Electric interlocking systems for railways." General Railway Signal Co. May 28th, 1931. (389307.)

13863. "Metal-vapour arc discharge apparatus." Akt.-Ges. Brown, Boveri et Cie. May 18th, 1931. (389311.)

14121. "Mercury-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. May 18th, 1931. (389312.)

14266. "Ventilating means for the laminated stators and rotors of electrical machines." P. Ehrmann. May 19th, 1931. (389313.)

14608. "Incandescent lamps." J. Van Eck and H. Fekkes. May 23rd, 1932. (389316.)

16707. "Radio and other high-frequency receivers." Marconi's Wireless Telegraph Co., Ltd. June 12th, 1931. (389326.)

17884. "Temperature indicators for electrical transformers." Westinghouse Electric & Manufacturing Co. July 23rd, 1931. (389335.)

13572. "Plug-and-socket coupling for alternative connections." C. A. T. Waldthausen. June 30th, 1932. (389339.)

19615. "Feeder or conductor systems for use on very short waves." Telefunken Ges. für Drahtlose Telegraphie. July 11th, 1931. (389346.)

20290. "Directional radio receiving systems suitable for use on aircraft." Telefunken Ges. für Drahtlose Telegraphie. July 16th, 1931. (389351.)

20612. "X-ray apparatus." C. H. F. Müller Akt.-Ges. July 22nd, 1931. (389355.)

20644. "Mercury-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. July 21st, 1931. (389356.)

22215. "Electro-magnetic valve." National Pneumatic Co. April 9th, 1932. (389370.)

22856. "Machines for packing electric incandescent lamps, thermionic valves, or the like into cartons." General Electric Co., Ltd. August 17th, 1931. (389385.)

25066. "Electric motors." British Sangamo Co., Ltd., and R. C. Lanphier, Jnr. September 8th, 1932. (389396.)

25180. "Electrical furnaces." J. Kuntziger, H. Delecourt, and J. Raison. September 18th, 1931. (389397.)

26298. "Lithium alloys and electrolytic process of producing the same." H. Osborg. July 4th, 1931. (Divided application on 19346/31.) (389150.)

26731. "Method for the production of submarine telephone cables." L. Mellersh-Jackson (Siemens & Halske Akt.-Ges.). September 26th, 1932. (389403.)

26814. "Bi-metallic thermal switches." English Electric Co., Ltd., and C. T. Scarf. September 27th, 1932. (389404.)

26891. "Sparking plugs." S.I.S.I. Soc. Italiana Sfruttamento Invenzioni. September 28th, 1931. (389405.)

27337. "Electrically driven clocks." Kienzle Taxameter-und-Apparate Akt.-Ges. December 3rd, 1931. (389406.)

27344. "Feeding means for a paper or metal band or strip, electric wire, sound film, or like continuous material." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 2nd, 1931. (389407.)

30086. "Lamps more particularly for vehicles." R. Bosch Akt.-Ges. November 26th, 1931. (389417.)

30125. "Luminous electric discharge lamps." General Electric Co., Ltd. November 17th, 1931. (389418.)

36309. "Device for effecting the light load regulation in induction meters." Landis & Gyr Akt.-Ges. December 31st, 1931. (389435.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 29th:—

Zenohm. No. 528537. Class 8. Electrical resistance units.—Zenith Electric Co., Ltd., Villiers Road, Willesden Green, N.W.2.

Tiger. No. 536954. Class 8. Radio receiving and transmitting sets, radio receiving sets in combination with gramophones, and parts thereof.—Ultra Electric, Ltd., Erskine Road, N.W.3.

Guardian. No. 539019. All goods in Class 8.—Peto Scott Co., Ltd., 77, City Road, E.C.1.

Cetex. No. 539345. Class 8. Radio-telephonic and other telephonic apparatus.—Cetex, Ltd., 19, Grosvenor Place, Westminster, S.W.1.

Mercutact. No. 539493. Class 8. Mercury switches.—Isenthal & Co., Ltd., Victoria Road, North Acton, W.3.

Orma. No. 539041. Class 13. Electric lamps (ordinary).—J. H. Valentine, trading as John Vale & Co., 146, Bishopsgate, E.C.2.

Diadem. No. 539384. Class 13. Electric fusible cut-outs, lamps (ordinary), switches (ordinary), and irons.—G. Ellam, 49, Gartside Street, Bridge Street, Manchester.

Roxaflex (lettering and design). No. 537626. Class 15. Reflectors made of glass.—G. F. Hardy, 3, St. Philip's Road, Surbiton, Surrey.

Ford. No. 537916. Class 50. Junction boxes made of ebonite, &c.—Ford Motor Co., Ltd., 88, Regent Street, W.1.

The Cost of Pulverising Coal

The summaries of progress in research and technical developments in the utilisation of coal and its by-products which are being issued by the Institution of Mining Engineers include Memorandum No. 9 on the cost of pulverising coal. Data from eight stations are analysed, the grinding capacity varying from 94,840 to 1,314,000 tons per year. The operating loads are low, varying from 12 to 65 per cent. of the installed capacity. The power used per ton pulverised is from 20 to 34.4 kWh, costing from 0.108d. to 0.19d. per kWh. The capital cost of the plant per ton-year varies from 21.7d. to 72.5d., and the total running cost, excluding obsolescence, varies from 9.3d. to 15.6d. per ton. The general conclusions are that the minimum costs are: power 2.1d., operating wages 1.0d., and maintenance and lubricants 2.1d. per ton.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ambleside (Westmorland).—Church and presbytery; J. Hughes, architect, Union Bank Chambers, St. Anne's-on-Sea, Lancashire.

Audenshaw (Manchester).—Re-erection of mill, York Street; International Cotton Waste Co.

Ayr.—Church for the St. John's Mission of the Episcopal Church (£3,000); rector, St. John's Church. Extension, Largs Higher Grade School; master of works, Education Committee.

Barking.—Houses and flats (265), Movers Lane, and Town Hall extension; borough engineer.

Barnet.—Improvements, Wellhouse Hospital; A. Saxon Snell & Phillips, architects.

Barnsley.—Houses (56), Burton Grange; borough surveyor.

Barrow-in-Furness.—Houses (38), Ancaster Street; F. Barrow. Alterations and additions, 113, Duke Street; Scottish Legal Life Assurance Co.

Birkenhead.—Development of Hawthorne Road; W. M. & M. W. Shennan.

Birmingham.—Library, College Road, Perry Common (£15,000); H. H. Humphries, city architect, Edmund Street. Three-storey addition for Mole & Son, Ltd., 51, Charlotte Street (£10,000); E. L. Turner, builders, 204, St. Vincent Street, Ladywood. Extensions for Anstey & Wilson, Ltd., Kenyon Street (£7,000); W. J. Whittall & Sons, builders, Lancaster Street.

Blantyre (Lanarkshire).—Re-erection of mill; Gideon Walker & Sons, Bell's Mills, Edinburgh (£3,000).

Bromsgrove.—Extensions, Cottage Hospital; Borough Surveyor's Department, Council House.

Burgh Heath.—Restaurant, ballroom, garages, &c; Ward's Garages (Burgh Heath), Ltd.

Chelmsford.—Library (£26,394); Ashford Builders Co., Ltd., contractors, Ashford. Showroom and offices, London Road; Wenley, Ltd. Works extensions, Writtle Road; Crompton Parkinson, Ltd.

Cheltenham.—Houses (80), Athlone Lawn Estate; borough engineer. Houses (21), Naunton Way; Naunton Estates, Ltd. Houses (15) and shops, Tennyson Road; A. L. Baynes.

Chesterfield.—Houses (800), Langer Lane; Silcockson & Cutts, architects, Slatergate.

Chislehurst.—Twelve shops, Green Lane, for Chislehurst Estates, Ltd.

Chorley.—Houses (10), Burgh Lane; Wm. Critchley. Houses (10), Oakwood Road; A. Derbyshire & Co. Houses (10), Russell Square West; George Berry.

Cirencester.—Bacon factory extensions, Chesterton, for Mason & Gillett.

Derby.—School, Sinfin (£8,957); Gee, Walker & Slater, builders.

Durham.—Schools, Burnhope (£6,600), and Easington Colliery (£28,000); F. Willey, county architect, 34, Old Elvet.

Easington.—Houses (20), opposite Craig Terrace, for H. G. Clarke, architect, Statford House, Wingate.

Eastbourne.—Six shops, The Avenue; P. D. Stonham & Son, architects.

East Preston (Sussex).—Houses (22); R.D.C. surveyor.

Eccles.—Alterations and additions, 2, Church Street; Cliftons Chocolates, Ltd.

Edinburgh.—Houses (22), Colinton Road; J. Jordan, architect, 12, Castle Street. Houses (124), East Pilton Street; Mr. Kaye, architect, 14, Hill Street. Houses (23), Stevenson Avenue; C. E. Tweedie & Sons, architects, 54, Frederick Street. Schools, Craigentinny (£27,000 and Granton (£32,000); city architect.

Evesham.—Houses (22), Broadway; A. Groves & Sons, builders.

Faversham (Kent).—Alterations and additions, Guildhall; S. P. Andrews, engineer and surveyor, 20, West Street.

Glasgow.—Houses, Quarrybrae Street (18), and Broomloan Estate (516); housing director and trade contractors. Buildings, St. Enoch Square (£16,177); J. S. Train & Co., Ltd. Catholic school, Berryknowes Road; education director. Alterations to Nicholson Street Barracks and Southern Police Buildings (£25,000); city architect.

Guildford.—Houses (156), Stoke Hill Estate (£39,390); D. Kenn & Sons, Ltd., Bexley. Development of Pareora Estate; C. Ossenton & Co. Houses (10), Manor Road; W. Hoptriff. Houses (10), Old Palace Road; Tribe & Robinson, Ltd. Alterations to Playhouse Cinema, Castle Street; County Cinemas, Ltd.

Hartshill (Staffs).—Houses (36), Shelton New Road; Holloway & Co.

Insch (Aberdeenshire).—Extensions, War Memorial Hospital; R. D. Donald, Bank House.

Irish Free State.—(Ballinasloe, Co. Galway).—Houses (41); J. L. Dunne, town surveyor. (Terenure, Dublin).—Telephone exchange, for the Commissioners of Public Works; T. Cassedy, secretary, Office of Public Works, Dublin.

Isle of Ely.—School, Parson Drove; R. D. Robson, county architect, March.

Keighley.—Houses (11), Surrey Street; T. A. Lister.

Llanelly.—Church, Penygroes (£2,473); J. H. Grindall, builder, Wem, Salop.

London.—(Acton).—Development of 5½ acres, Western Avenue; Mr. Atkinson. (Catford).—Alterations, 116-8, Rushey Green; Boots Pure Drug Co., Ltd. (Finchley).—Houses (55), Parkside Crescent; Golders, Ltd. Eight shops and four flats, Regent's Park Road; C. F. Day, Ltd. Shops, Woodhouse Road; Halliwick Manor Estate. Extensions, Council offices (£3,987); Mattock Bros., Wood Green. (Highgate).—Laboratory, Archway Hospital (£3,575); L.C.C. architect. (Southgate).—Bus garage and shops, Enfield West Station and Bowes Road; London Electric Railway Co. Eight shops and flats, Winchmore Hill Road; C. W. Dennis. (Tottenham).—Factory, Abbotsford Avenue; Hart Percival, Ltd. (Wandsworth).—Motor vehicle works, &c., Camborne Road (£42,500); L.C.C. architect. (West Ham).—School dining centre (£2,000) for Borough E.C.; clerk. (East Ham).—Houses (15); Gainsborough Avenue; W. Goodchild & Co. Houses (20), Grantham Road; G. Seigerts. Houses (48), Walton Road; J. H. Lohden.

Lowestoft.—Business stores, London Road South, for the Co-operative Society; Roberts, Green & Richards, architects, London Road.

Maidenhead.—Ballroom, &c., Bridge Road and Oldfield Road, for the Empire Building & Trading Co.

Maidstone.—Theatre, Lower Stone Street, for Bernstein Theatres, Ltd., 197, Wardour Street, London, W.

Middlesbrough.—Houses, Brambles Farm Estate (100), Whinney Banks Estate (112), and Bridge Road (190); S. E. Burgess, borough engineer, Town Hall.

Middlesex.—Elementary school, The Walk, Potters Bar, for County E.C.

Morecambe.—Houses (20), Buckingham Road; Wm. Gardner & Co. Houses (14), Morecambe Road; A. Heathcote. Building estate, Westgate; Brook & Kershaw. Development of Broadgate Estate; F. Obank.

Morpeth.—Housing estate (15 acres); A. K. Tasker, architect, Trinity Buildings, Newcastle.

Mossley.—Houses (50), Waterton Lane site (electric lighting installations); A. Deane, builder, 19, Buckley Street, Droylsden.

Newcastle-on-Tyne.—Houses (48), Armstrong Road; R. F. Wackett, builder, Balfour Road. Houses (16), Hauxley Gardens; F. M. Dryden, architect, 6, Market Street. Houses in flats (58) on the Two Ball Lonnen Estate, for Messrs. W. Hall, Ltd., contractors, Derwentwater Road, Gateshead. Conversion of Grey Street cinema into offices and showrooms for Smart Bros., Ltd.; Marshall & Tweedy, architects, 129, Pilgrim Street.

Nottingham.—Cinema, Mansfield Road, Sherwood, with electrical installation (£11,000); A. J. Thraves, architect, Whitefriars House, Friar Lane.

Plymouth.—Catholic church and houses, Barne Estate; Rev. Father Symons. Factory, Water Lane, Stonehouse; Co-operative Society, Ltd. Admission hospital (£27,066) and additions to college, Ford Park; A. N. Coles & Son, Ltd., builders, Queen Ann Battery.

Portsmouth.—Extensions, Cathedral church (£70,000); Sir Charles Nicholson, architect.

Rochford (Essex).—School, Leigh Beck, Canvey (£5,800); Hosking & Sons, builders.

Romford.—Rebuilding post office, South Street; H.M. Office of Works, King Charles Street, S.W.1.

Rotherham.—Houses (30), Beechwood Road, for G. Bilton & Son, Broom Road.

St. Albans.—Alterations, Oster House Institution (£21,945); Herts Assistance Committee.

St. Helens (Lancs).—Houses (30), Leach Lane, for Mr. Twist.

Scunthorpe & Frodingham.—Houses (50), Crosby Estate; Lumley & Bray, builders, Winterton.

Sheffield.—Cinema, Back Road, for Shiregreen Cinema Syndicate, Ltd. (electrical installation); C. B. Malam Wilson & Gardham, architects, Campo Chambers, 30, Campo Lane.

Sittingbourne.—Paper mill extensions, for Edward Lloyd, Ltd.; P. Denson, managing director.

Southampton.—Church, Woolston (£7,000), for the Methodist trustees; Rev. T. Shirley Herrick.

Southborough (Kent).—Houses (20); U.D.C. surveyor.

Southend-on-Sea.—Alterations to premises, Hamlet Court Road, for F. W. Woolworth, Ltd., Victory House, Kingsway, London.

Southport.—Houses (12), Cromer Road; A. H. & E. W. Jackson.

South Shields.—Houses (142), Quarry Lane (£31,369); J. P. Watson, borough engineer, Town Hall.

Stoke-on-Trent.—Houses (40), Victoria Square; Col. H. Clive.

Surrey.—School (384 places), Cheam, for County E.C.; W. W. Finny, secretary, Kingston-on-Thames.

Sutton Coldfield.—Houses (21), Kineton Road; J. White. Houses (12), South Parade; Mrs. S. E. Wright.

Tenterden (Kent).—Houses (24); R.D.C. surveyor.

Tynemouth.—Houses (23), Tynemouth Park Estate; G. Park, Ltd., builders, Tynemouth Road.

Watford.—Houses (100), Leavesden Green (£27,858); Stewart & Co. Houses (18), Leggatts Way; borough engineer. Houses (24), Stanborough Estate; W. Farren & Son. Factory extension, High Street; Grosvenor Electric Batteries, Ltd. Factory extension, St. Albans Road; Granose Food Co. Branch library, Garston (£4,000); librarian.

Walsall.—Bazaar premises, Park Street, for Marks & Spencer, Ltd.; Bovis, Ltd., builders, Upper Berkeley Street, W.1.

Warrington.—Premises, Sankey Street; Marks & Spencer, Ltd.

Wells (Somerset).—Rebuilding Town Hall; E. P. Foster, town clerk.

West Bromwich.—Houses (65), Hambletts Estate; borough engineer.

York.—Houses (150), Huntington Road, and flats (40), Dodsworth Avenue; city architect. Houses (24), Irwin Avenue; H. Williamson.

Automatic Traffic Signals

On March 29th Mr. Parkinson asked the Minister of Transport if he could state the number of points that were now worked by automatic traffic signals in London.

Mr. Oliver Stanley said that ninety-four street intersections in the Metropolitan Police District and in the City of London were now controlled by traffic light signals. Arrangements had been completed or were in progress for the introduction of signals at a large number of other junctions.